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Division of Agricultural Sciences

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# IMPACTS OF LEMON PRODUCTS IMPORTS ON DOMESTIC LEMON MARKETS

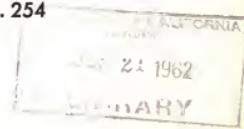
**Sidney Hoos and George M. Kuznets**

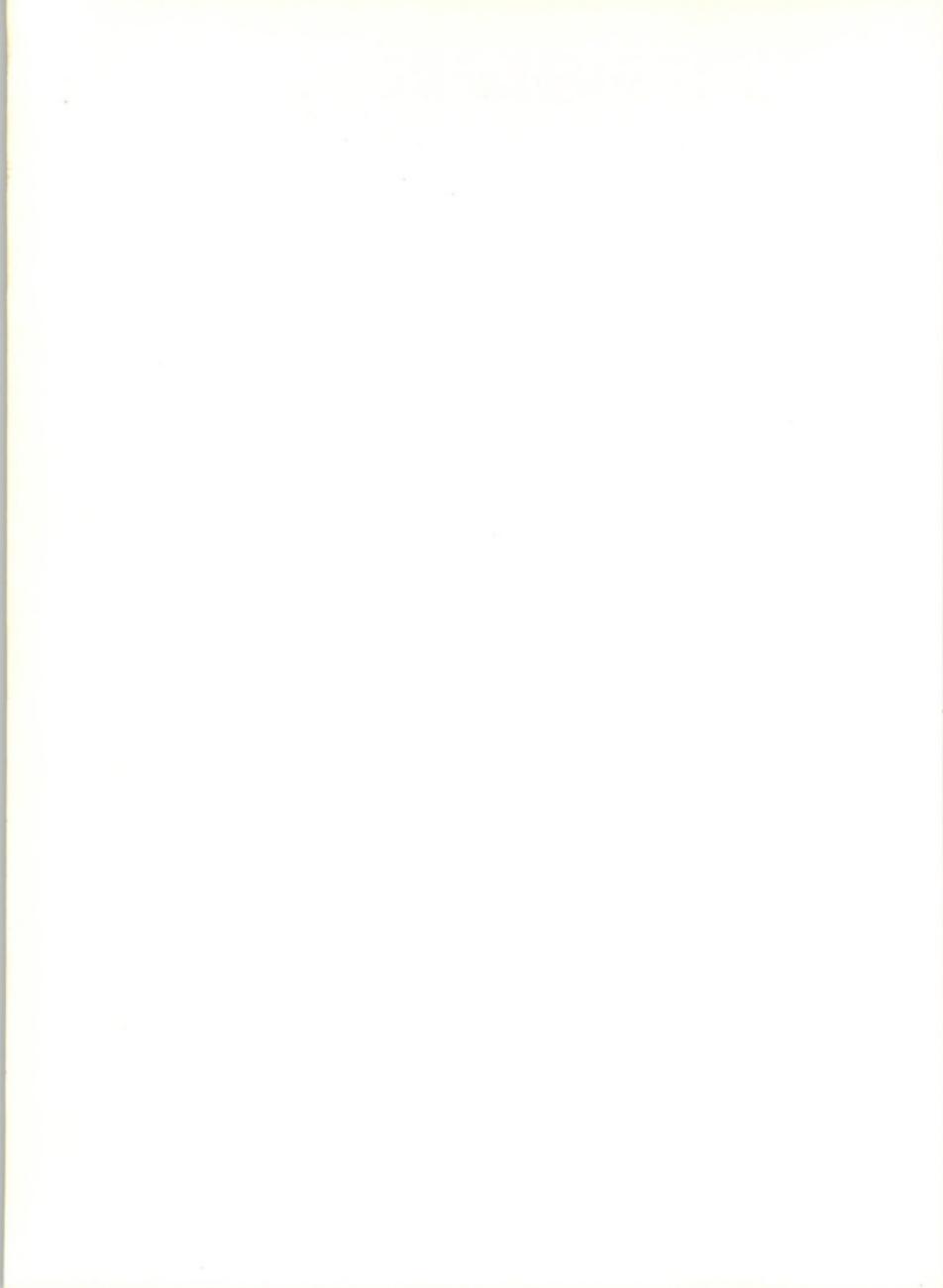
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CALIFORNIA AGRICULTURAL EXPERIMENT STATION  
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IMPACTS OF LEMON PRODUCTS IMPORTS ON DOMESTIC LEMON MARKETS

by

Sidney Hoos<sup>1/</sup> and George M. Kuznets<sup>2/</sup>

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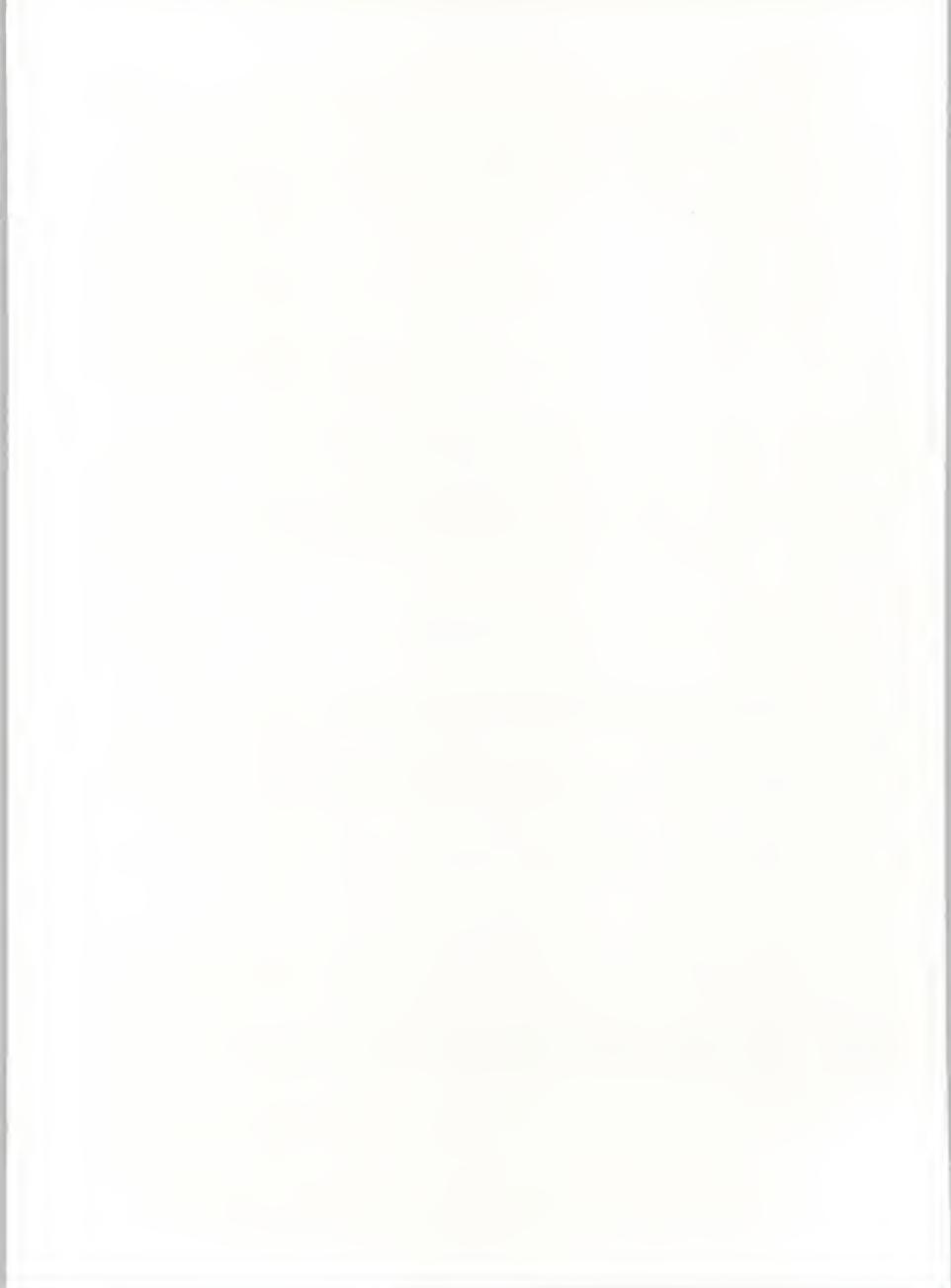
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## IMPACTS OF LEMON PRODUCTS IMPORTS ON DOMESTIC LEMON MARKETS

### I. INTRODUCTION

#### The Report

Lemons and lemon products have been the subject of several economic and marketing studies in recent years.<sup>1/</sup> The changing nature of problems in the lemon industry calls for periodic investigation of the current and prospective situation. Earlier studies have been concerned with developments in the fresh lemon and lemon products markets and with the economic-marketing relationships among them. This report updates various parts of previous studies and, in addition, presents new materials and findings on the interactions among fresh and processed lemons. In particular, economic-statistical evidence is presented concerning the impacts which domestically produced and imported lemon juice products have on the domestic market prices of fresh lemons.

The growing importance of the lemon products market, in terms of the proportion of crop-production processed, injects problems and raises questions concerning the prices and returns from fresh shipping as well as processing lemons. In addition to market impacts of domestically produced lemons and lemon products, complicating influences arise from the further augmentation of lemon products supply through the importation of processed lemon products from abroad.

To investigate the economic-marketing influences and relationships underlying the supply-demand and price situation in the domestic lemon industry, necessary background materials are reviewed and discussed. Then, economic-marketing analyses are presented which are relevant to an understanding of the nature of the demand for fresh lemons and the influence of lemon juice

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<sup>1/</sup> Lemons and Lemon Products; Changing Economic Relationships, 1951-52, California Agricultural Experiment Station Bulletin 729 (Berkeley, 1952), 78p.

Lemons--Fresh and Products--Economic Problems, Practices, and Policies, University of California, Giannini Foundation Mimeographed Report No. 190 (Berkeley, 1956), 116p.

The Economic Situation in the Lemon Industry (Berkeley: California Agricultural Experiment Station, 1960), 25p.

products. The results and findings are evaluated and their implications considered from the view of marketing policy and programs.

In the second major section of the report, attention is directed to the trends and current situation in domestic lemon production and its basic determinants. The third section is concerned with trends in the utilization of the lemon crop. Section IV examines the structure of lemon products and their prices. In Section V, the record of and situation in lemon products imports are investigated. Relevant segments of these background materials are integrated in Section VI. There, economic-statistical analyses and findings are presented on the demand for fresh lemons largely in terms of their f.o.b. and grower on-tree prices related to domestic fresh lemon shipments, volumes of domestic and imported lemon juice products, and other demand-affecting factors such as consumer income. Section VII interprets and evaluates the economic-statistical findings with particular reference to their meaning for understanding the economic-marketing impacts of lemon juice products imports on the domestic fresh lemon market. The final section considers and discusses the findings in terms of their implications for domestic marketing policy and programs in the context of the current and prospective situation in the lemon industry. The various statistical tables in the text portions of the report are supplemented by appendix tables which include additional relevant statistical data and information.

#### Summary

As further introductory commentary, below are briefly noted in capsule summary form some of the leading highlights of the substance and findings presented in detail in the following sections of the report:

Production of lemons in California-Arizona, during the past decade, has varied from year to year but followed an upward trend.

California-Arizona's total lemon acreage has been stable the past several years and at a higher level than in the early 1950's. The higher level is due to Arizona acreage.

California lemon bearing acreage has downtrended during the past decade, with a tendency toward leveling out in recent years. In Arizona, lemon bearing acreage continues to uptrend, but also with a tendency to level out the past several years.

California-Arizona lemon nonbearing acreage, during the past decade, trended up until 1957-58 and since then has receded.

California-Arizona percent nonbearing acreage, during the past decade, trended up irregularly until 1957-58 and since then has receded to about 20 percent.

The average yield of California lemons (production divided by lemon bearing acreage), although irregular from year to year, has trended upwards during the past decade. An all-time peak was reached in 1958-59.

Fresh shipments have trended upwards slightly during the past decade. A substantial drop occurred in 1958-59, although some recovery has resumed since then.

The proportion of the lemon crop shipped fresh continues to trend down, although the trend was interrupted in 1959-60.

The utilization of lemon production is now about even between the fresh and products outlets.

The per-capita consumption of fresh lemons has trended down during the past decade, while that of lemon juice products has trended up.

Fresh lemon exports have averaged higher during the latter half than in the first half of the past decade.

Imports of lemon juice (pasteurized concentrate), although irregular during the past decade, have averaged higher in the latter than in the first half.

Exports of lemon juice products (single-strength juice, pasteurized and frozen concentrate) have increased in recent years.

The f.o.b. prices for California-Arizona fresh shipping winter lemons have averaged lower during the second half of the past decade than during the first half.

The f.o.b. prices for California-Arizona fresh shipping summer lemons have also averaged lower in the second half of the past decade than in the first half.

The cost of producing and marketing California packed lemons has averaged higher in the latter half of the past decade than in the first half.

The on-tree prices to California growers for both fresh shipping and processing lemons have been variable during the past decade, averaging considerably lower in the second half than in the first half.

Increases in the volume of fresh shipments tend to depress the f.o.b. and on-tree prices of fresh shipping lemons; price increases are associated with decreased shipments.

Increases in the volume of consumer purchases of lemon juice products tend to result in decreases in the f.o.b. and on-tree prices of fresh shipping lemons.

Imports of lemon juice products adversely affect the f.o.b. and on-tree prices of fresh shipping lemons.

Increases in disposable personal income tend to raise the f.o.b. and on-tree prices of fresh shipping lemons; adverse price effects result from decreases in disposable personal income.

The demand for fresh lemons marketed during summer months has shifted down slightly but noticeably in recent years.

The fresh lemon shipping market and the lemon juice products market are interrelated in consumption competition and are interlocked in economic-marketing operations.

Imports of lemon juice products affect the domestic fresh lemon market as well as the juice products market; the impact occurs through increase of supply of lemon juice products.

The operations of the federal marketing order for fresh shipping lemons, to stabilize market prices and improve grower returns, are adversely affected by imports of lemon juice products.

The economic-statistical analyses underlying the above brief summary statements are set forth in the following sections of the report.

## II. TRENDS IN DOMESTIC LEMON PRODUCTION AND ITS DETERMINANTS

### Production

The domestic production of lemons varies widely between successive years. Since 1934-35, a production low of 7.6 million boxes (in 1936-37) and a record peak of 17 million boxes (in 1959-60) were experienced--a range of 9.4 million boxes.

An up-and-down movement, with fluctuations in the individual years, occurred during the 12-year period from 1936-37 to 1948-49. Since then, the production has trended up, but with the continuation of substantial year-to-year variation over the period. From 1959-60 to 1960-61, production receded 2.5 million boxes. Yet the status of bearing and nonbearing acreage (considered below) suggests that new record production levels are to be attained in the next half dozen years.

To trace the production trend during the past quarter century, but highlight the situation in recent years, the production data are summarized in Table II-1.

The general uptrend in domestic lemon production is clearly evident from the summary tabulation. Although production in California greatly surpasses that in Arizona, it is of more than passing interest that production in Arizona has trended up sharply, in percentage terms, during the past decade. The production potential in Arizona, in terms of botanical and citricultural dimensions, far exceeds the level attained so far. Yet in the past, present, and near future, it is the California production of lemons which heavily dominates the industry output.

The basic determinants of lemon production are number of bearing acres and yield per bearing acre. Thus, to account for the behavior of production over time, it is necessary to examine the historical records of both yield and bearing acreage.

TABLE II-1  
Production of California and Arizona Lemons

Years	California	Arizona million boxes	Total California- Arizona
<u>Five-year averages</u>			
1934-35 to 1938-39	9.3		9.3
1939-40 to 1943-44	13.4	a/	13.4
1944-45 to 1948-49	12.8	0.1	12.9
1949-50 to 1953-54	13.3	0.1	13.4
1954-55 to 1958-59	15.5	0.2	15.7
<u>Crop year</u>			
1954-55	14.0	0.1	14.1
1955-56	13.3	0.2	13.5
1956-57	16.2	0.2	16.4
1957-58	16.9	0.4	17.3
1958-59	16.9	0.3	17.2
1959-60	17.0	1.1	18.1
1960-61	14.5	0.6	15.1

a/ Less than 50,000 boxes.

Source: Sunkist Growers, Marketing Research Department, Statistical Information on the Citrus Fruit Industry, Oranges, Lemons, Grapefruit, 1961, August, 1961, p. 12. (Cited hereafter as Statistical Information, 1961.)

### Yield Per Bearing Acre

Resulting from the interaction of production and number of bearing acres, yield is a measure of physical productivity in the growing of lemons. Although not to be confused with economic returns, yield per bearing acreage affects net returns received by growers. The trend in average yield per bearing acre of lemons produced in California-Arizona is summarized in Table II-2.

The extent to which year-to-year changes occur in lemon yield per bearing acre is evident from Table II-2. Of particular interest is that the sharply increasing yield trend during the past decade accounts for the up-trend in production during the period; as noted below, bearing acreage was trending downward during most of the period. These comments apply to California and California-Arizona combined since the latter situation is dominated by what occurred in California.

A different situation emerges when Arizona is considered alone. There the yield trend has also risen sharply in recent years while lemon growing has expanded. But the Arizona situation calls for a different interpretation. The uptrend in yield reflects in large, and perhaps most, part the preponderance of young trees. As they grow and mature, their bearing capacity and potential increase rapidly. Thus, as the average age of the Arizona orchards increases, their yield will continue to advance until maturity is reached and a leveling out in yield develops; thereafter increased yields will depend more on improved cultural practices and technology. In the meantime, however, the yield influence of Arizona lemon orchards can be expected to have relatively large impacts on the growth of production.

### Bearing Acreage

The record of bearing acreage of lemons outlines the producing base of the industry. If yield per bearing acre were constant, production and bearing acreage would be perfectly correlated, and one would serve as an index of the other. But in view of the variability in yield, as noted above, it is necessary to give individual attention to the behavior of bearing acreage over time.

TABLE II-2  
Yield per Bearing Acre of California-Arizona Lemons

Years	California	Arizona	Total
			California-Arizona
<u>boxes per bearing acre</u>			
<u>Five-year averages</u>			
1934-35 to 1938-39	208		
1939-40 to 1943-44	245		
1944-45 to 1948-49	207		
1949-50 to 1953-54	241		
1954-55 to 1958-59	300	80 <sup>a/</sup>	293
<u>Crop year</u>			
1954-55	265		266
1955-56	253	125	249
1956-57	318	111	311
1957-58	331	190	325
1958-59	335	70	314
1959-60	329	244	322
1960-61	286		

a/ Four-year average.

Source: Computed from production and bearing acreage data in Statistical Information, 1961.

The trend in bearing acreage of lemons in California and Arizona is summarized in Table II-3.

During the past quarter century, California lemon bearing acreage experienced an up and then down cycle. With slightly over 41 thousand acres bearing in 1934-35, a gradual uptrend during the following dozen years resulted in 63 thousand bearing acres in 1946-47. The more than 50-percent increase in California bearing acreage during those dozen years established an all-time record peak shortly after the close of World War II. Thereafter, California bearing acreage receded, at first rapidly and then slowly. During the past half decade, the lemon bearing acreage in California has been near constant, hovering near 50-51 thousand acres.

In Arizona, the number of acres bearing lemons grew relatively rapidly beginning in 1955-56. Within one year, between 1957-58 and 1958-59, Arizona bearing acreage more than doubled. Since then, the recorded increase has been slight.

When California-Arizona bearing acreages are considered together, it is found that the situation in Arizona clearly affects the trend in recent years. There has been a noticeable increase since 1956-57, with all of the increase accounted for by what happened in Arizona. By 1959-60, the combined bearing acreage in the two states (56,200 acres) was at about the same level that existed 10 years earlier (1949-50) and also 17 years earlier (1942-43).

With a continuation in the uptrend in lemon bearing acreage in California-Arizona, and with the maintenance of yield, lemon production will uptrend further. To the extent that yield will increase because of maturing orchards and can be raised through improved cultural practices and agro-technology, production could be increased even more.

#### Nonbearing Acreage

The level and trend in nonbearing acreage is an index of new production to be entering the market in the next several years. Unless offset by acreage withdrawn from production, nonbearing acreage foreshadows coming additions to productive potential and capacity. Even in well-established lemon growing areas, as in the coastal area of southern California, nonbearing

TABLE II-3

## Bearing Acreage of California-Arizona Lemons

Years	California	Arizona thousand acres	Total California- Arizona
<u>Five-year averages</u>			
1934-35 to 1938-39	44.7		44.7
1939-40 to 1943-44	54.7		54.7
1944-45 to 1948-49	61.7		61.7
1949-50 to 1953-54	55.2		55.2
1954-55 to 1958-59	51.6	2.5 <sup>a/</sup>	53.6
<u>Crop year</u>			
1954-55	52.9		52.9
1955-56	52.6	1.6	54.2
1956-57	51.0	1.8	52.8
1957-58	51.1	2.1	53.2
1958-59	50.4	4.3	54.7
1959-60	51.7	4.5	56.2
1960-61	50.7		

<sup>a/</sup> Four-year average.

Source: Statistical Information, 1961, p. 13.

acreage may offset tree removal due to overaged or low-producing trees. In a new area, as in the desert area of California or in Arizona, relatively substantial nonbearing acreage is particularly to be expected. Only when an industry is in chronic decline does nonbearing acreage tend to decline persistently and over a considerable period of time.

The historical record of nonbearing lemon acreage in California and Arizona is summarized in Table II-4.

The variability over time in California nonbearing lemon acreage reflects activity in the planting of orchards in established growing areas of the state and the opening of new areas. For the state as a whole, there was a downtrend in nonbearing acreage from the middle 1930's until the middle 1940's. Thereafter a slow but continuing uptrend occurred, reaching a recent peak in 13,800 acres in 1958-59. Since then, some receding has occurred. Latest data (1960-61) indicate a level about the same as the first half of the 1950's.

In Arizona, there was a relatively sharp increase in the latter half of the 1950's, with a peak at 4,100 acres in 1957-58. Since then, a decline to somewhat over 2,000 acres is recorded. But the fact exists that nonbearing acreage comprises a very substantial proportion of total lemon acreage in Arizona. This indicates that continued increase in lemon production may be expected in Arizona at least during the coming 6 to 10 years.

For California-Arizona combined, nonbearing acreage of lemons accounted for slightly over 20 percent of total lemon acreage, as an average for 1954-55 to 1958-59. In 1959-60, the latest year for which complete data are presently available, nonbearing acreage was slightly under 20 percent of total lemon acreage in California-Arizona. This is a proportion adequate, in view of historical experience, to provide for normal replacement and average growth.

The relation of nonbearing to total lemon acreage may be further highlighted by the summary data in Table II-5.

Clearly emphasized in Table II-5 is the large percent of nonbearing acreage in Arizona. Although the proportion has gone down in recent years, it now stands at a healthy figure--about one-third. The proportion in California, as may be expected, is much smaller. A decrease is reflected during the past three years; nonbearing acreage close to 14 percent of total acreage in 1960-61. This is near the figure experienced in the early 1950's, and exceeds that which prevailed during the latter half of the 1940's.

TABLE II-4

## Nonbearing Acreage of California-Arizona Lemons

Years	California	Arizona thousand acres	Total California- Arizona
<u>Five-year averages</u>			
1934-35 to 1938-39	15.7		15.7
1939-40 to 1943-44	12.5		12.5
1944-45 to 1948-49	5.3		5.3
1949-50 to 1953-54	8.4		8.4
1954-55 to 1958-59	11.3	3.2 <sup>a/</sup>	13.9
<u>Crop year</u>			
1954-55	8.7		8.7
1955-56	9.5	2.6	12.1
1956-57	11.5	3.9	15.4
1957-58	13.1	4.1	17.2
1958-59	13.8	2.2	16.0
1959-60	11.7	2.3	14.0
1960-61	8.1		

a/ Four-year average.

Source: Statistical Information, 1961, p. 13.

In overall terms, either in acres or as a percent of total acres, the nonbearing acreage situation in the California-Arizona lemon industry may be viewed as not being seriously out of line with reasonable expectations. For the area as a whole, nonbearing acreage is adequate to support the maintenance of bearing capacity in the near future, and to provide a firm but not excessive base for growth in productive potential.

#### Total Acreage

With the preceding reviews of bearing and nonbearing acreage of lemons in California-Arizona, this section on production and its determinants approaches a terminal point. As closing comments, however, it is relevant to survey briefly the situation in total lemon acreage, bearing and nonbearing combined. The pertinent summary data are in Table II-6.

With 58,000 acres in 1934-35, the total lemon acreage in California uptrended to a peak of 68,000 acres in 1942-43. Since then, with some annual fluctuations, the trend has been down. For 1960-61, the recorded figure is 58,800 acres or about the same as in 1934-35.

Beginning with data in 1955-56, Arizona total acreage of lemons has trended up, with an easing in the rate of advance during the past two years. Of significance is that when the California-Arizona area as a whole is considered, total acreage has trended up more than in California alone. When the average of the past three years is viewed as a basis for comparison, California-Arizona lemon acreage has been at a historically high level.

Bearing acreage, in combination with yield, underlies the level of production in recent years compared with earlier ones. Also, the breakdown of total acreage into its bearing and nonbearing components and distribution now and in the coming several years, again in combination with yield behavior, will determine the trend and level of production in the near future. It is for that reason that consideration was given above to the trend and behavior of yield, bearing and nonbearing acreage, as the determinants of production.

TABLE II-5  
Percent of Nonbearing Acreage of California-Arizona Lemons

Years	California nonbearing	Arizona acres as percent of total acres	Total California- Arizona
<u>Five-year averages</u>			
1934-35 to 1938-39	26.0		26.0
1939-40 to 1943-44	18.6		18.6
1944-45 to 1948-49	7.9		7.9
1949-50 to 1953-54	13.3		13.3
1954-55 to 1958-59	17.9	57.6 <sup>a/</sup>	20.4
<u>Crop year</u>			
1954-55	14.1		14.1
1955-56	15.3	61.9	18.3
1956-57	18.4	68.4	22.6
1957-58	20.4	66.1	24.4
1958-59	21.5	33.8	22.6
1959-60	18.4	33.8	19.9
1960-61	13.8		

a/ Four-year average.

Source: Statistical Information, 1961, p. 13.

TABLE II-6  
Total Acreage of California-Arizona Lemons

Years	California	Arizona thousand acres	Total California- Arizona
<u>Five-year averages</u>			
1934-35 to 1938-39	60.4		60.4
1939-40 to 1943-44	67.2		67.2
1944-45 to 1948-49	67.0		67.0
1949-50 to 1953-54	63.6		63.6
1954-55 to 1958-59	62.9	5.7 <sup>a/</sup>	67.4
<u>Crop year</u>			
1954-55	61.6		61.6
1955-56	62.1	4.2	66.3
1956-57	62.5	5.7	68.2
1957-58	64.2	6.2	70.4
1958-59	64.2	6.5	70.7
1959-60	63.4	6.8	70.2
1960-61	58.8		

a/ Four-year average.

Source: Statistical Information, 1961, p. 13.

### III. TRENDS IN UTILIZATION OF LEMON PRODUCTION

#### Fresh Shipments and Products

The disposition of California-Arizona lemon production occurs in several forms. The outlets include domestic fresh shipments, exports of fresh lemons, and manufactured lemon products. Each of these outlets is by itself a separate market, yet they are not independent of each other. What occurs in each one of the market outlets affects, and is affected by, what occurs in the other market outlets. In an economic-marketing sense, the fresh lemon and lemon products markets are interrelated and interlocked.

The interconnections between the fresh lemon and lemon products markets occur at both ends of the production-consumption pipeline. At the initial end of the pipeline, the crop of a particular year is partly shipped fresh for fresh-use consumption and part of the crop is manufactured for ultimate consumption in products form. At the terminal end of the pipeline, consumers shift back and forth between the purchase of fresh lemons and lemon products in response to uses, tastes, and particularly relative prices. Such shifts influence and reflect market interrelations among the fresh and products outlets.

To indicate the distribution of California-Arizona lemon production between the fresh and products outlets during the past decade, the historical data are presented in Table III-1.

In terms of trend, California fresh shipments drifted up from the middle 1930's to the early 1940's. For several years, shipments then were rather stable but declined fairly heavily between 1946-47 and 1948-49. Thereafter, an uptrend occurred again, reaching a peak of 10.2 million boxes in 1957-58. Since then, fresh shipments have been at a lower level--between 8.5 and 9.0 million boxes annually. In overall terms, California fresh lemon shipments have historically been relatively stable, not advancing as much as production, the behavior of which was examined earlier.

With annual variations clearly evident, the products use of California lemons has followed an upward trend since the middle 1930's. The increase has been particularly pronounced during the postwar years. During 1954-55 to 1958-59, the average products utilization of California lemons was about three times as great as the average of 1934-35 to 1938-39, and in 1959-60 was four

TABLE III-1

Fresh Shipments and Products Utilization of California-Arizona Lemons<sup>a/</sup>

Years	California		Arizona		California-Arizona	
	Fresh	Prod- ucts	Fresh	Prod- ucts	Fresh	Prod- ucts
million boxes						
<u>Five-year averages</u>						
1934-35 to 1938-39	7.3	2.0			7.3	2.0
1939-40 to 1943-44	8.8	4.6	-- <sup>b/</sup>	--	8.8	4.6
1944-45 to 1948-49	8.9	3.9	--	--	8.9	3.9
1949-50 to 1953-54	8.2	5.2	--	--	8.3	5.1
1954-55 to 1958-59	9.3	6.2	0.1	0.1	9.4	6.3
<u>Crop year</u>						
1954-55	9.2	4.8			9.2	4.9
1955-56	9.1	4.2	0.1	0.1	9.2	4.3
1956-57	9.6	6.6	0.1	0.1	9.7	6.7
1957-58	10.2	6.7	0.2	0.2	10.4	6.9
1958-59	8.6	8.3	0.1	0.2	8.7	8.5
1959-60	9.0	8.0	0.4	0.7	9.4	8.7
1960-61						

<sup>a/</sup> Total, including exports.<sup>b/</sup> Dashes indicate less than 50,000 boxes.Source: Statistical Information, 1961, p. 12.

times as great. In trend terms, the products outlet has been absorbing an increasing proportion of California lemon production and in recent years has approached the fresh proportion.

In Arizona, although the crop production has been at a much lower level, the distribution between the fresh and products outlets has been more even than in California. The products market, in relative terms, has been even more important for Arizona lemon production than that in California. By 1959-60, with increased tonnage of Arizona lemons going to processing, one and three-fourths times as much lemon crop production was channeled into the products outlet as into the fresh outlet.

When California-Arizona combined are considered, again may be noted the extent to which the products outlets have taken an increasing importance. Not only is a marked uptrend in products clearly evident, and the extent to which products lemons have increased faster than fresh shipments, but also that in the most recent several years the products market has approached the fresh market in volume disposition.

Another way in which the distribution of California-Arizona lemon crop production has been distributed between the fresh shipping and manufacturing dispositions is set forth in Table III-2. There is shown the percent of the crop shipped fresh, with the remaining percentage being viewed as used in products.

The extent to which fresh shipments of California lemons have declined as a percentage of crop production, with a corresponding increase in the percentage going to products, is evident from the data in Table III-2. Whereas only 20 percent of the California crop was processed, on the average, during the five-year period 1954-55 to 1958-39, by 1958-59 and 1959-60 close to half of the crop was processed. The trend has not been entirely smooth, but it has been clear and persistent.

In Arizona, the situation has been even more striking. There, during the past several years, the manufactured products outlets for the lemon crop production have become dominant. By 1959-60, close to only about one-third of the Arizona lemon crop was shipped fresh, with near to two-thirds of the crop being processed. The lemon industry in Arizona is dependent on the products market even to a greater extent than is the industry in California.

The percentage distribution between fresh and products outlets for the lemon crop production of California-Arizona combined is, of course, heavily

TABLE III-2

Percent of Fresh Shipments of California-Arizona Lemon Crop Production

Years	California	Arizona percent	Total California- Arizona
<u>Five-year averages</u>			
1934-35 to 1938-39	80.3		80.3
1939-40 to 1943-44	67.3	63.5	67.3
1944-45 to 1948-49	70.3	80.7	70.3
1949-50 to 1953-54	62.9	70.8	62.9
1954-55 to 1958-59	60.9	45.9	60.7
<u>Crop year</u>			
1954-55	65.6	50.2	65.6
1955-56	68.4	42.9	68.1
1956-57	59.5	55.4	59.4
1957-58	60.2	39.1	59.7
1958-59	50.9	42.1	50.8
1959-60	52.8	36.4	51.7
1960-61			

Source: Statistical Information, 1961, p. 12.

dominated by what occurs in California. This is due to the much larger volume in California. But even in that state, the products outlet is becoming increasingly significant, as noted earlier.

The distribution of the California-Arizona lemon crops between fresh and manufactured products outlets results from the interaction of a number of economic-marketing influences. Of major significance is the federally approved Fresh Lemon Marketing Agreement-Order operated by the industry under the authority of the U. S. Secretary of Agriculture. Through the order, the volume of fresh domestic shipments is regulated weekly to affect prices and returns to growers. In view of the demand characteristics for fresh market lemons, as will later be noted, the marketing order does not allocate the entire crop for shipment to the fresh market. Only part of the crop receives "pro-rate" for fresh shipments, and the rest of the crop is destined for uses other than fresh shipments to domestic fresh marketing.

As shown above, the volume of fresh lemons shipped has been fairly stable in the past two or two and one-half decades, with the increasing crop production being absorbed mostly in the products outlets. This changing distribution in utilization of the lemon crop reflects in large part the operations of the Fresh Lemon Marketing Agreement-Order program. The economic-marketing relationships involved, their causes and effects, will be considered in detail in later sections of the report. But here it suffices to note that the fresh and products markets are interrelated and that grower returns from the fresh market are affected by the operation of the federal marketing agreement-order for fresh lemon shipments by the California-Arizona industry.

#### IV. THE STRUCTURE OF LEMON PRODUCTS AND THEIR PRICES

##### The Structure of Lemon Products

The two preceding sections of the report have reviewed the course of California-Arizona lemon production and its physical determinants and have reviewed the changing distribution of the crop utilization. The increasing trend in production during the past decade has been absorbed mostly through increased processing, while the domestic fresh market has expanded only nominally.

At this point it is necessary to recognize that the products segment of the lemon industry encompasses a group of products or commodities, rather than being a single product. Here, again, the various lemon products involve a set of interrelated markets interconnected at both the initial processing and terminal consumption points of the distribution pipeline. The relationships at the processing level come about since processing lemons can be manufactured into any one of several commodities. The relationships at the terminal consumer level occur because consumers may shift among several of lemon products in view of their relative prices as well as consumer uses, tastes, and preferences.

A major use of processing lemons is their manufacture into juice products, which include single-strength juice (canned and frozen), concentrated juice, and lemonade concentrate (frozen and nonfrozen). Domestically produced or imported concentrated lemon juice can be used in the manufacture of various consumer juice products. For such uses, domestically produced and imported concentrated lemon juice are substitutable. For our purposes, it is not necessary to consider the technical differences among various consumer products. It is adequate to recognize that these are physically different products, each with its own markets and supply-demand characteristics but that, in economic-marketing terms and operations, the various submarkets form a set of interrelated markets. What happens in one has repercussions in the other markets. The repercussion may be evident immediately, or it may take some time to become apparent. But, sooner or later, the market interactions become evident.

To set forth the structure of lemon juice products, it is necessary to consider their production, f.o.b. sales, and inventories held at the processing points. The production data, for the period beginning in 1945-46, are summarized in Table IV-1.

TABLE IV-1

Production of Lemon Juice Products from California-Arizona Lemons

Crop year (November- October)	Single-strength juice		Concen- trated juice	Lemonade concentrate		Total
	Canned	Frozen		Frozen	Non- frozen	
	thousands of equivalent single-strength gallons					
1945-46	2,116	219	1,615			3,950
1946-47	1,103	151	1,408			2,662
1947-48	1,659	231	2,574			4,464
1948-49	1,533	179	3,340			5,053
1949-50	1,749	549	3,543	1,419	281	7,541
1950-51	1,263	455	1,751	2,838	322	6,629
1951-52	1,651	799	2,022	4,699	346	9,517
1952-53	2,261	1,078	3,540	6,354	343	13,576
1953-54	1,138	799	9,352	6,865	343	18,497
1954-55	1,979	831	4,261	5,349	175	12,595
1955-56	2,366	1,257	2,216	6,734	234	12,807
1956-57	2,022	1,062	8,409	6,428	141	18,062
1957-58	2,964	1,710	7,432	8,041	304	20,451
1958-59	2,713	1,414	15,603	8,687	228	28,645
1959-60 <sup>a/</sup>	3,108	775	13,353	9,789	342	27,368
1960-61 <sup>a/</sup>						

<sup>a/</sup> Preliminary.

Source: Sunkist Growers, Marketing Research Department.

The phenomenal growth in the production of lemon juice products from California-Arizona lemons during the postwar years is indicated in the final column of Table IV-1. From near 5 million gallons in 1948-49, and even less in previous years, production has risen strongly so that during the recent years, 1958-59 and 1959-60, in the order of more than 27 and 28 million gallons were produced. The uptrend has not only been strong but was reflected in the figures for most of the individual years.

The bulk of the increased production in lemon juice products was accounted for by the expanded manufacture of two products: concentrated lemon juice and frozen lemonade concentrate. Single-strength juice, both canned and frozen, has shown rising trends, but they were neither sharp nor sustained. Nonfrozen lemonade concentrate, however, fluctuated about a level trend and reflected erratic annual changes.

The production of concentrated lemon juice which averaged 1.5 million gallons in 1945-46 to 1946-47 had reached over 15.5 million gallons in 1958-59. The uptrend was erratic and slow at first but accelerated sharply after the middle 1950's. Production in 1956-57 was nearly four times that of the preceding year, and production more than doubled in a single year from 1957-58 to 1958-59.

The uptrend in production of frozen lemonade concentrate has not been as spectacular as that of concentrated lemon juice, but the former has been more consistent with less variability. From 1949-50 to 1959-60, frozen lemonade concentrate increased sevenfold and reached a record peak. The record peak in concentrated lemon juice had been reached in the preceding year, 1958-59. But aside from such details, it is clear that in overall terms the aggregate production of lemon juice products during the past several years has been very substantially greater than a half-dozen years earlier.

What happened to the increased production of lemon juice products? The volumes moved through processing plant sales are summarized in Table IV-2.

Examination of the data in Table IV-2 indicates that all of the lemon juice products, except nonfrozen lemonade concentrate, experienced an uptrend in sales during the past decade. But it was only beginning with 1956-57 that sales of canned single-strength juice have increased substantially; prior to then and back to 1950-51, sales were erratic and began trending up only in 1954-55. By 1959-60, the sales of canned single-strength lemon juice exceeded 3 million gallons.

TABLE IV-2  
Sales of Lemon Juice Products from California-Arizona Lemons

Crop year (November- October)	Single-strength juice		Concen- trated juice	Lemonade concentrate		Total
	Canned	Frozen		Frozen	Non- frozen	
	thousands of equivalent single-strength gallons					
1950-51	1,363	292	2,800	2,131	324	6,910
1951-52	1,761	681	3,399	4,753	450	11,044
1952-53	1,756	832	2,853	5,741	322	11,504
1953-54	1,362	854	3,000	6,003	237	11,456
1954-55	1,980	969	3,828	6,154	249	13,180
1955-56	1,872	1,025	4,980	6,515	219	14,611
1956-57	2,250	977	6,640	6,287	180	16,354
1957-58	3,010	1,505	9,181	7,364	175	21,235
1958-59	2,964	1,482	7,600	8,679	167	20,892
1959-60 <sup>a/</sup>	3,192	1,596	10,488	7,813	167	23,256
1960-61						

a/ Preliminary.

Source: Sunkist Growers, Marketing Research Department.

The sales of frozen single-strength lemon juice also followed a rising trend. In relative terms, the growth of frozen single-strength lemon juice since 1950-51 has been even stronger than the nonfrozen. The frozen increased about fivefold during the past decade compared with under a tripling of the nonfrozen canned single-strength lemon juice. But when the frozen and non-frozen single-strength lemon juices are combined, they make up a significant proportion of total sales of lemon juice products.

In the most recent year for which complete data are presently available, 1959-60, concentrated lemon juice had the largest sales of all the lemon juice products, almost 10.5 million gallons. But that was unusual. In previous years of the 1950's decade, sales of concentrated juice were significant but not always the largest in the juice products group. Prior to 1955-56, concentrated juice sales were under 5 million gallons and at 2.8 million gallons in 1950-51. But since then, the trend has been up and strongly so in the past several years.

Frozen lemonade concentrate sales have also trended up during the past decade. In all of those years, the sales of frozen lemonade concentrate exceeded those of single-strength juices (canned and frozen). Lemonade concentrate sales also exceeded those of concentrated juice, except in 1950-51, 1956-57, 1957-58, and 1959-60. Canned single-strength juice sales exceeded those of frozen single-strength juice and nonfrozen lemonade concentrate. The combined sales of lemonade concentrate and concentrated juice comprise the bulk of total sales of lemon juice products.

The sales of nonfrozen lemonade concentrate are the smallest in the lemon juice products group. At the beginning of the 1950's decade, sales of frozen single-strength lemon juice and of nonfrozen lemonade concentrate were about of the same order of magnitude. The former has trended up while the latter has gone down, so that by the end of the 1950's decade there was a very large difference in sales with the nonfrozen lemonade concentrate being in a minor position.

When the processing plant sales of California-Arizona lemon juice products as a group are examined, it is clear that an uptrend has prevailed during the past decade. Each year has not seen an increase over the preceding year, but in most years an increase occurred. The rising trend has not been consistently smooth. Sharp advances developed between 1950-51 and 1951-52; for the next

three years, little change or a small to moderate increase was experienced; from 1956-57 to 1957-58, another sharp advance developed; and in 1959-60 a considerable increase was registered. For the decade as a whole, from 1950-51 through 1959-60, sales of lemon juice products had advanced from 6.9 to 23.2 million gallons (single-strength equivalent). This reflected a very substantial growth in the f.o.b. sales of California-Arizona lemon juice products.

Production and sales of lemon juice products, however, do not tell the complete story of what has happened in the juice products markets and in supply-demand developments. It is true that production must be available from which sales can be made, but inventories also enter the picture. In an extreme case, and for a given period, sales could occur without new production; and sales could be made by withdrawals from inventory. In a given period there is an accounting equation which prevails among production sales and inventory; and inventory at the beginning of the period, plus production, minus inventory at the end of the period equals sales during the period. To complete the production sales-inventory equation, therefore, we next turn to a review of developments in the inventory (at processing points) of California-Arizona juice products for which historical summary data are presented in Table IV-3.

The year-end inventories of canned single-strength lemon juice (nonfrozen) during the past decade have varied between 226,000 and 844,000 gallons, with no definite trend up or down developing. This is in contrast with the frozen single-strength juice inventories at year end, which exhibit an uptrend. There have been annual fluctuations, but during the latter half of the 1950's, the inventory level has averaged noticeably higher than in earlier years.

It is in the year-end inventories of concentrated juice that a truly strong increase has occurred, particularly in the two recent years 1958-59 and 1959-60. But even prior to those years, since the end of World War II, concentrated juice inventories exceed those of the other items in the lemon juice group. Also, in the frozen lemonade concentrate, inventories have tended to trend up. They certainly have averaged higher in recent years than during the early 1950's.

When the total or aggregate year-end inventories of lemon juice products are examined, it is found that wide fluctuations have generally occurred, with sharp increases in 1958-59 and 1959-60. These latter reflect what occurred those years in the concentrated juice category noted above. But the fact exists that relatively heavy inventories of lemon juice products, particularly in

TABLE IV-3

Inventories of Lemon Juice Products from California-Arizona Lemons<sup>a/</sup>

Crop year (November- October)	Single-strength Juice		Concen- trated juice	Lemonade concentrate		Total
	Canned	Frozen		Frozen	Non- frozen	
	thousands of equivalent single-strength gallons					
1946-47	259	13	724			996
1947-48	482	34	549			1,065
1948-49	226	28	542			796
1949-50	540	41	1,874	165		2,620
1950-51	377	217	1,883	677	178	3,332
1951-52	287	240	543	642	72	1,784
1952-53	816	469	1,478	1,161	74	3,998
1953-54	546	400	5,937	2,062	110	9,055
1954-55	403	274	2,689	969	72	4,407
1955-56	844	455	3,477	1,151	94	6,021
1956-57	581	521	4,870	1,300	62	7,334
1957-58	638	312	3,040	2,280	61	6,331
1958-59	456	274	11,605	1,687	61	14,083
1959-60	372	532	14,334	2,903	53	18,194
1960-61						

<sup>a/</sup> Inventories on hand, at processing storage plants, at close of crop year.

Source: Sunkist Growers, Marketing Research Department.

the concentrated juice component, had accumulated and were held by processors at the end of both 1958-59 and 1959-60.

These heavy inventories reflect the fact that sales did not keep up with production. The increased channeling of lemons into processing was accompanied by increased production of lemon juice products. Sales did increase, but not nearly enough to prevent building up of heavy inventory holdings at the processing points of the production-distribution-consumption pipeline. A result is that the lemon industry entered the 1960-61 crop year with large stocks of processed lemons in the form of juice products and, particularly, concentrated lemon juice. There is, then, the question as to what impacts were reflected on the structure of prices of lemon juice products.

#### The Structure of Lemon Products Prices

Examination of lemon products prices may be undertaken by various means. A desirable objective, however, is to obtain a meaningful view of what happened without getting lost in a myriad of irrelevant details. Toward such an objective, one approach is to review the course of prices for leading products, those which are in an economic-marketing sense the leading indicators of the market supply-demand situation.

In Table IV-4 are shown the prices prevailing since 1956 for processing lemons, concentrated lemon juice (325-gram nonfrozen and 400-gram frozen), and lemon oil, respectively. The price for lemons reflects the overall processing situation encompassing the interrelations and interactions of all of the products processed from lemons. The concentrated lemon juice prices reflect the situation in the juice products group. The price for lemon oil reflects a leading component nonjuice item in the lemon products category.

Examination of the price data in Table IV-4 for concentrated lemon juice (nonfrozen and frozen, respectively) clearly indicates a downward drift in the prices of concentrated lemon juice since near the middle of 1956. Out of the six changes in price for concentrated lemon juice shown in the table, half were increases and half were decreases. But the cumulative effect of the decreases substantially outweighed the cumulative effect of the increases; the net effect was a substantial decrease, as is evident by comparing the price near the close of 1960 and in March of 1961 with the prices prevailing in the middle of 1956. The downdrift in the price of concentrated lemon juice reflects the growing pressure of production-supply in relation to demand, which

TABLE IV-4  
Price Changes in Products Lemons, Concentrated  
Lemon Juice, and Lemon Oil

Date <sup>a/</sup>	Products lemons per ton	Concentrated lemon juice per gallon		Lemon oil per pound
		325-gram nonfrozen	400-gram frozen	
		dollars		
Year 1956 prior to May 14	60.00	5.60	6.85	6.00
May 14, 1956	55.00	5.60	6.85	5.00
Dec. 3, 1956	35.00	3.56	4.19	5.00
Mar. 11, 1957	30.00	3.56	4.19	4.00
Nov. 24, 1958	40.00	4.32	5.10	4.00
Jun. 22, 1959	32.50	3.76	4.41	3.50
Jan. 11, 1960	27.50	3.76	4.41	2.90
Feb. 22, 1960	20.00	3.73	4.36	1.50
Nov. 1, 1960	25.00	4.12	4.84	1.50
Mar. 13, 1961	39.50	4.79	5.94	1.95

<sup>a/</sup> Dates are those on which prices on products lemons became effective. Price changes on other products occurred at approximately the same time but not always on the same date.

Source: Sunkist Growers, Marketing Research Department.

was reflected in another way through the upbuilding of inventory noted above. The small increase in price effective March 13, 1961, is accounted for in most part by the reduced crop of 1960-61 referred to earlier. The crop reduction by itself may have been expected to produce a larger increase in price but such was precluded by the existence of record heavy inventory.

The price of lemon oil has downtrended sharply since the middle of 1956. Then prevailing at \$6.00 per pound, the successive decreases brought the price down to \$1.50 per pound by the end of 1960, or at a level only 25 percent of that four and one-half years earlier. The slight increase to \$1.95 per pound, effective March 13, 1961, again reflected the combined influence of the short crop in 1960-61 and the already available depressing supply.

Turning to the price of products lemons as an indicator of the overall lemon products supply-demand situation, a clear picture of developments again emerges. Since the middle of 1956, the price per ton of products lemons has trended down. November 24, 1958, an increase of \$10 per ton was made effective, but it could not be held; and in June, 1959, a reduction was made. Continued decreases brought the price down to \$20 per ton in February, 1960. Increases near the end of 1960 and in March, 1961, brought the price up to \$39.50 per ton. But even at that level, it was only two-thirds of the price prevailing in the middle of 1956.

Another view of price developments in the lemon products markets may be obtained by examination of the data in Table IV-5. There are shown average annual returns for the crop years since 1953-54 for products lemons used in juice products as a group, for oil, for other peel products, and for total products, respectively.

The crop-year average annual returns for juice products as a group were \$55 per ton of products lemons in 1953-54 but declined during the following two years, reaching \$13 per ton in 1956-57 and remaining there in 1957-58. A \$5.00 per-ton increase occurred in the next year, 1958-59, and receded to \$17.50 for 1959-60. In that year the average per-ton lemon products annual returns for juice products amounted to 32 percent of the average returns per ton in 1953-54, only six years earlier.

The downtrend in the average annual returns from products lemons for lemon oil was even more precipitous. At \$20 per ton in 1953-54, the returns declined in 1954-55 and again in 1955-56, reaching \$14 per ton, which level prevailed through 1957-58. But the next year, another decline occurred and still another

TABLE IV-5

Average Annual Returns Reflected by Market Prices of Products Lemons in Years 1953-54 to 1959-60

Year	Juice products	Oil dollars per ton	Other peel	Total <sup>a/</sup>
1953-54	55.00	20.00	·	75.00
1954-55	41.00	16.00	2.00	59.00
1955-56	37.00	14.00	3.00	54.00
1956-57	13.00	14.00	3.00	30.00
1957-58	13.00	14.00	3.00	30.00
1958-59	18.00	12.00	2.00	32.00
1959-60	17.50	3.00	.50	21.00

a/ The total column is the products fruit sale average price at the Sunkist Lemon Products Division. The other columns are average industry returns, estimated on the basis of average prices in effect during each of the years.

#### Components of Recent Products Lemon Prices

Date	Price per ton	Approximate components		
		Juice- products	Oil dollars	Other peel
November 24, 1958	40.00	25.00	12.00	3.00
January 11, 1960	27.50	17.50	10.00	0
November 1, 1960	25.00	22.50	2.50	0
March 13, 1961	39.50	34.50	5.00	0

Source: Sunkist Growers, Marketing Research Department.

decrease--a very sharp one--is recorded for 1959-60. Hence, by 1959-60, the returns from oil were only 15 percent of the level in 1953-54.

Other peel products also have declined sharply over the period shown in Table IV-5. With a \$2.00 per-ton return in 1954-55, an advance of \$1.00 per ton was registered in the following year and prevailed through 1957-58. But the next year, the return receded again to \$2.00 per ton where it was in 1954-55; yet, the end was not in sight; in 1959-60 the average return was \$0.50 per ton. This 50-cents figure for products lemons used in other peel was 25 percent of the corresponding figure in 1954-55, and 16-2/3 percent of the figure in 1955-56 through 1957-58.

The final column in Table IV-5 shows the average annual returns of products lemons for all uses. With \$75 per ton in 1953-54, the next two years exhibited decreases reaching \$30 per ton in 1956-57 and remaining there in 1957-58. A \$2.00 per-ton increase occurred for 1958-59, but in the next year, a sharp decline to \$21 per ton was made. Thus, over the seven-year period 1953-54 to 1959-60, the weighted average overall price fell \$54 per ton with the 1959-60 price being merely 28 percent of the 1953-54 price.

The price developments reviewed through the data in Tables IV-4 and IV-5 reflect market prices at the processing f.o.b. levels of the marketing system. To obtain a view of the situation from a different standpoint, and one which reflects the direct impacts of the changing level and structure of lemon products prices on lemon growers, we next consider the developments as reflected by on-tree prices.

Relevant summary data on grower on-tree prices are shown in Table IV-6 for fresh shipping lemons, products lemons, and the weighted average for all uses. (It is to be noted that these prices are not deflated or adjusted for the decreasing value or purchasing power of the dollar over the period covered by the data. If the data were so adjusted, a less favorable picture would emerge from the viewpoint of lemon growers.)

The on-tree prices received by growers for fresh shipping lemons have fluctuated annually. After the Great Depression of the 1930's, fresh shipping lemons advanced in price along with all other products, nonagricultural and agricultural. Peaks were attained in the early 1950's, but since then the fresh lemon on-tree prices have drifted down. Particularly clear is the tendency for the price to remain within the \$2.25-\$2.65 (per packed box) range

TABLE IV-6

On-Tree Prices of California Lemons, Fresh and Processed

Years	Fresh dollars per packed box	Processed equivalent	All use
<u>Five-year averages</u>			
1934-35 to 1938-39	2.19	0.25	1.85
1939-40 to 1943-44	2.18	0.24	1.58
1944-45 to 1948-49	3.08	-0.12	2.15
1949-50 to 1953-54	3.48	1.01	2.55
1954-55 to 1958-59	2.71	0.09	1.69
<u>Crop year</u>			
1954-55	2.95	0.14	1.99
1955-56	3.28	0.38	2.36
1956-57	2.45	0.12	1.51
1957-58	2.24	0.20	1.43
1958-59	2.64	-0.38	1.16
1959-60	2.42	-0.70	0.93

Source: Statistical Information, 1961, p. 37.

during the past several years. Throughout most of the period, however, the federal Fresh Lemon Marketing Agreement-Order has been in operation, regulating the flow of fresh lemons to market. Without such regulation, and with the increasing crop production, the on-tree grower prices for fresh lemons would not have retained the levels they did experience. But that portion of the increasing crop production not shipped fresh was channeled into the lemon products market.

The on-tree prices for lemons used in products have historically been less than the corresponding on-tree prices for fresh shipping lemons. Also, products lemons have generally had low on-tree returns. An exception was when the new product frozen lemonade concentrate was introduced in 1949-50 and enjoyed rapid market acceptance and development in the early 1950's. But since 1953-54, on-tree prices for lemon products have regressed closer to the level prevailing in the earlier years. Furthermore, "red-ink" or negative on-tree grower returns were recorded for 1953-59 and 1959-60. Such price developments reflected the increasing volume of lemons channeled into processing as a consequence of the increasing crop production and the operation of the federal marketing agreement-order regulating the shipments of fresh lemons. At certain points, the importation of processed lemons in various forms played a role as will be noted in the following section.

The weighted average on-tree prices received by growers for lemons in all uses are shown in the final column of Table IV-6. Of particular note is the extent to which the on-tree prices for processed lemons have an impact on the weighted average on-tree prices. This is due to the relative weight of lemons processed. As the processing volume continues to increase in relation to the fresh shipping volume, the downdrag on the weighted average on-tree price will become stronger.

## V. LEMON PRODUCTS IMPORTS

### Lemon-Producing Countries

The preceding discussion and analysis of production and utilization pertained to the lemon crop in the United States. Although this country is the leading lemon producer, it is not the only major one. Lemons are produced for sale through commercial channels in other countries also. In that context, Italy is a leading producer as well as a major source of lemons and lemon products shipped to other countries. The known distribution of lemon production throughout the world is summarized in Table V-1.

The data in Table V-1 indicate that the United States accounts for less than half of the world lemon production. The Mediterranean countries--Greece, Spain, and Italy--are of significance. In fact, Italy ranks next to this country in volume of production. Further, "all other" countries, including Syria, Lebanon, Israel, Turkey, Argentina, Chile, Australia, Union of South Africa, in the aggregate, represent substantial production.

It is of significance to note that the production of lemons in the Mediterranean group of Greece, Italy, and Spain has generally followed an uptrend. It was arrested in the World War II period, but following the reconstruction there and during the past decade the uptrend has resumed.

The expanding production of lemons in the Mediterranean region, particularly in Italy, has been associated with increased exports of both fresh lemons and lemon products. Of direct relevance to the subject investigated in this report is the impact of such exports of lemon products on the markets in the United States, especially its market for lemon products. In that connection, attention is shortly directed to the situation in the importation of lemon products into the United States. But as prior background, it is first pertinent to note the structure of tariff rates on lemon products imports into the United States.

### Tariff Duty Structure

In Table V-2 is set forth the tariff rate specifications applicable to the importation of lemon products into the United States. The specifications are shown for the Tariff Act of 1930 and subsequent changes thereto as recorded in official documents noted in the footnotes to the table.

TABLE V-1  
World Production of Lemons

Years	United States	Greece	Italy	Spain	All other	Total world
<u>million boxes</u>						
<u>Five-year averages</u>						
1934-35 to 1938-39	9.3	0.4	9.9	1.5	2.9	24.0
1939-40 to 1943-44	13.4	0.4	9.4	1.4	4.1	28.7
1944-45 to 1948-49	12.8	0.5	7.3	1.1	4.1	25.8
1949-50 to 1953-54	13.4	1.0	8.5	1.5	5.1	29.5
1954-55 to 1958-59	15.7	1.4	10.0	1.2	7.1	35.4
<u>Crop year</u>						
1954-55	14.1	1.2	9.2	1.0	6.2	31.7
1955-56	13.5	1.3	8.8	1.1	6.4	31.1
1956-57	16.4	1.4	9.9	0.5	7.0	35.2
1957-58	17.3	1.6	10.3	1.2	7.3	37.7
1958-59	17.2	1.7	11.6	2.0	8.9	41.4
1959-60	18.1	2.1	10.0	2.0	8.4	40.6
1960-61	15.1	1.8	9.3	2.1	a/	a/

a/ Data not available.

Source: Statistical Information, 1961, p. 18.

TABLE V-2  
Rates of Duty on United States Imports of Lemon Products

Lemon products	Tariff paragraph	Unit	Tariff Act of 1930	Effective rate or trade agreement rate
<u>Lemon juices</u>				
Concentrated--fit for beverage	806(b)	cents per gallon <sup>a/</sup>	70.0	55.0 <sup>b/</sup>
Unconcentrated--less than 1/2 per cent alcohol	806(a)	cents per gallon	70.0	20.0 <sup>b/c/</sup>
<u>Lemonade</u>	808	cents per gallon	15.0	5.0 <sup>b/</sup>
<u>Lemon oil</u>	58	per cent ad valorem	25.0	17.5 <sup>d/</sup>
<u>Lemon peel</u>				
Candied, crystallized, glace', or otherwise prepared or preserved	739	cents per pound	8.0	6.0 <sup>d/</sup>
Crude, dried, or in brine	739	cents per pound	2.0	1.5 <sup>d/</sup>
<u>Citric acid</u>	1	cents per pound	17.0	8.5 <sup>e/</sup>

a/ Rates apply to the unconcentrated natural fruit juice content.

b/ General Agreement on Tariffs and Trade (GATT) (Geneva), effective January, 1948.

c/ Geneva 1956 Agreement (GATT) reduced the rate on unconcentrated citrus juices from 20 cents per gallon to 19 cents, effective June 30, 1956; 18 cents effective June 30, 1957; and 17 cents effective June 30, 1958.

d/ General Agreement on Tariffs and Trade (GATT) (Annecy), effective May, 1950.

e/ General Agreement on Tariffs and Trade (GATT) (Torquay), effective July, 1951.

Sources: U. S. Tariff Commission, U. S. Import Duties, 1950, and United Nations, General Agreement on Tariffs and Trade.

The two more important lemon products which have been imported into the United States include concentrated lemon juice (often referred to as pasteurized concentrate) and lemon oil. The large bulk of such imports has originated in Italy. Concentrated lemon juice imports are subject to duty under the Tariff Act of 1930 [paragraph 806(b)]. There, set at 70 cents per gallon on the quantity of unconcentrated natural juice contained in the concentrated juice "as shown by chemical analysis," the duty rate on concentrated lemon juice was subsequently reduced to 35 cents per gallon, effective January 1, 1948, through the General Agreement on Tariffs and Trade, GATT (Geneva). For imports of lemon juice unconcentrated (less than 1/2 percent alcohol), the Tariff Act of 1930 set the duty rate at 70 cents per gallon; the GATT (Geneva) agreement, effective January 1, 1948, reduced the rate on unconcentrated lemon juice from 70 cents to 20 cents per gallon. The GATT (Geneva) agreement of 1956 reduced the rate on unconcentrated lemon juice from 20 cents per gallon to 19 cents per gallon, effective June 30, 1956; 18 cents per gallon, effective June 30, 1957; and 17 cents per gallon, effective June 30, 1958. Thus, from the Tariff Act of 1930 to the currently effective rate, the duty on concentrated lemon juice had been reduced by one half or 50 percent; and the duty on unconcentrated lemon juice had been reduced from 70 cents to 17 cents per gallon, or a reduction of 75 percent.

The Tariff Act of 1930 (paragraph 58) set the import duty on lemon oil at 25 percent ad valorem. GATT (Annecy), effective May, 1950, reduced the import duty on lemon oil to 17.5 percent ad valorem, a reduction of 7.5 percentage points. The changes in the duty rates for other lemon products, from the Tariff Act of 1930 to the currently effective rate, are shown in Table V-2 and need not further be commented on here, except to note that in all cases reductions occurred.

#### Imports and Exports

The importations of lemon juice into the United States, during the years since the end of World War II, are summarized in Table V-3.

From Table V-3, it may be noted that the imports of lemon juice trended up from 1948-49 to 1955-56 when the figure reached 2.57 million gallons (single-strength equivalent). This amounted, in 1955-56, to about 34,300 tons or 1,940 railroad cars of fresh fruit equivalent. Since 1956-57, the imports of lemon juice have varied from 160,000 gallons (single-strength equivalent) in 1957-58

TABLE V-3  
Lemon Juice Imports into United States<sup>a/</sup>

Crop year (November-October)	Pasteurized concentrate
	million gallons of single- strength equivalent
1948-49	0.39
1949-50	0.73
1950-51	0.82
1951-52	0.70
1952-53	1.78
1953-54	2.41
1954-55	2.45
1955-56	2.57
1956-57	1.45
1957-58	0.16
1958-59	1.69
1959-60	0.17

<sup>a/</sup> The table shows imports of lemon juice concentrate (in single-strength equivalent). In addition, there were the following imports of single-strength lemon juice: 1,636 gallons in 1948-49; 2,386 gallons in 1949-50; 7,504 gallons in 1950-51; and 3,356 gallons in 1951-52.

Source: Statistical Information, 1961, p. 30.

to 1,690,000 gallons in 1958-59. The following section in the report analyzes the economic-marketing effects of imports on the price of fresh lemons in the United States.

To round out the picture, it is relevant to note that exports of lemon juice products are made from the United States. Summary data on exports of lemon juice products are shown in Table V-4. The exports of lemon juice products have followed an uptrend, reaching 2.25 million gallons (single-strength equivalent) in the 1959-60 crop year.

TABLE V-4  
Lemon Juice Exports from the United States

Crop year (November-October)	Single-strength juice, pasteurized and frozen concentrate	
	To Canada	Total
	million gallons of single- strength equivalent	
1951-52		0.21
1952-53		0.17
1953-54	0.14	0.15
1954-55	0.17	0.84
1955-56	0.19	1.13
1956-57	0.22	1.53
1957-58	0.33	2.09
1958-59	0.31	2.08
1959-60	0.34	2.25

Source: Statistical Information, 1961, p. 30.

Returning to imports again, we next consider the situation in lemon oil. The relevant data are summarized in Table V-5.

The variability of lemon oil imports into the United States is evident from data in Table V-5. Of particular note is the major position of Italy as the source of lemon oil imports into this country. When the import data for both lemon juice (Table V-3) and lemon oil (Table V-5) are examined in light of the domestic prices for lemon juice products and products lemons in the

TABLE V-5  
Lemon Oil Imports into the United States

Calendar year	From Italy	From other	Total
		countries pounds	
Average: 1935-1939	117,500	5,328	122,828
1947	50,549		50,549
1948	213,851	27,745	241,596
1949	145,169	8,735	153,904
1950	181,976	26,342	208,318
1951	284,077	7,375	291,452
1952	31,948	3,872	35,820
1953	101,213	11,891	113,104
1954	88,799	13,053	101,852
1955	30,311	9,061	39,976
1956	64,683	20,382	85,065
1957	70,750	19,550	90,300
1958	47,274	8,913	56,187
1959	61,177	20,031	81,208
1960	54,255	43,302	97,557
1961	163,792	25,130	188,922

Source: U. S. Department of Commerce, Bureau of the Census, Monthly Summary of Foreign Commerce of the U. S. and Annual Reports No. FT 110, U. S. Imports . . . Commodity by Country . . . (Washington, D. C.). Lemon oil is specified as No. 2276000.

United States, it is found that there exists a tendency for imports to move directly with the domestic prices--the higher the domestic price, the greater are the imports of lemon products. Such relationship may be expected in view of trade principles and practices. Yet, it is a meaningful and relevant question to consider the impacts of the lemon products imports on the lemon market prices in this country and to examine the extent to which the imports of lemon products affect the price of lemons in the United States domestic lemon market. This, among other questions, is considered in the next section.

## VI. STATISTICAL APPRAISAL OF DEMAND RELATIONSHIPS BETWEEN FRESH AND PROCESSED LEMONS<sup>1/</sup>

The scheme underlying statistical study of economic phenomena consists of (a) specification of a particular set of relations constraining the variables of the problem (the set may consist of a single element) and (b) specification of the statistical properties of some or all of the variables. The two kinds of description are combined to produce a statistical model of the economic phenomena under study to serve as a consistent basis for statistical measurement. The latter may take the form of estimating the numerical magnitudes of certain parameters which may be useful in considering policy questions and in testing assertions about phenomena studied. Or the emphasis may be placed on the prediction of values of some variables corresponding to assigned values of other variables.

It is fair to say that in most econometric studies the specification of the statistical elements of the model (that is, of the stochastic variables) tends to be pro forma. That is to say, it is not derivable from the body of relevant theory or unambiguously inferrable from direct observation, if such is possible, of the economic behavior under consideration. Some elements of the statistical specification (typically of minor substantive import) are subject to statistical test. Some of the more basic structural characteristics of the model, however, cannot be so tested. Among these is the categorization of variables as mutually determined (endogenous) or as the givens of the problem (exogenous) corresponding to the controlled or conditioning variables in an experiment. This distinction cannot be disregarded in empirical work. It affects statistical procedure even when emphasis is placed solely on prediction. Aggregation over time and units forced by exigencies of empirical measurement will introduce mutual dependence, at least in subsets of variables, even if the basic economic structure is describable as strictly recursive.

The categorization of variables as endogenous or exogenous in a given problem illustrates an essential feature of econometric models. Of necessity,

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<sup>1/</sup> The results and implications of this section's findings, as they bear on the impacts of lemon juice imports on the domestic fresh lemon market, are indicated in nontechnical terms in Section VII.

these models contain statements the validity of which cannot be assessed either directly or by testing secondary statements (deductions) entailed by the basic propositions of the model. It follows further that there exists a multiplicity of "plausible" models of relevance to a given problem among which objective choice is really not possible. Multiplicity of "explanations" is not unique to econometrics; it probably characterizes all scientific investigation. What is, perhaps, distinctive is that the nonexperimental sciences do not have access to controlled observation as the effective means of reducing the number of credible models.

The unavoidable multiplicity of theoretical descriptions in economics seriously affects the character of empirical testing. In econometrics, the implication of an empirical result obtained on the basis of one credible model would itself gain in credibility if it were shown to be invariant over the whole set of plausible models or over some subset thereof. The answer to the question, "Is there competition in demand between fresh and processed lemons?"--if it results from a statistical analysis that is strictly conditioned by a particular conceptual representation--becomes more credible if it can be shown that the results can be similarly interpreted on the basis of some alternative specifications. Empirical study in economics is only to a minor extent a search for evidence which would assist in discriminating between alternative hypotheses. It is largely a search for results which lead to robust inferences, that is, to inferences that are not sensitive to differences in alternative specifications.

#### Structure of Demand for Fresh and Processed Lemons

Only those aspects of marketing processes are sketched out in this subsection which are of direct relevance to the statistical study of the relatedness of demand for fresh and processed lemons. The emphasis is placed on the explicit formulation of demand functions. We concern ourselves with supply behavior only to the extent necessary to be able to make rational decisions about the statistical estimation of the relevant demand parameters.

1. Consumer Demand Functions.--The quantity demanded of fresh or of processed lemons,  $q_{ft}^d$  and  $q_{jt}^d$ , respectively, in time unit  $t$  is assumed to depend on the price of fresh lemons,  $p_{ft}$ , the price of lemon products,  $p_{jt}$ , and the magnitudes of some other variables  $z_{1t}, \dots, z_{kt}$ . These relations are not satisfied

exactly, but up to a random disturbance,  $u_{ht}$ , specified to be normally distributed, independently over  $t$ , with zero mean and a fixed variance.

$$\text{Fresh: } q_{ft}^d = h^1(p_{ft}^r, p_{jt}^r, z_{1t}, \dots, z_{kt}) + u_{1t} \quad (1)$$

$$\text{Processed: } q_{jt}^d = g^1(p_{ft}^r, p_{jt}^r, z_{1t}, \dots, z_{kt}) + u_{2t} \quad (2)$$

Consumers (buyers) act as price takers who "realize" on their demand functions by adjusting quantities purchased to given prices. If the unit of time  $t$  is sufficiently short, the prices  $p_{ft}$  and  $p_{jt}$  can be treated as controlled variables. Similarly, the variables  $Z$ , among which we include such demand "shifters" as income and temperature, are assumed to be determined outside of the small subsystem being considered and are treated as given. These considerations permit the substitution in (1) and (2), for the unobservable quantities demanded, of actual quantities purchased by consumers of fresh lemons and lemon products,  $q_{ft}^r$  and  $q_{jt}^r$ .

2. Demand Functions Facing Handlers of Fresh Lemons.--In time unit  $t$ , the quantity of fresh lemons demanded of handlers (say by wholesalers) is assumed to depend on the wholesale price of fresh lemons,  $p_{ft}^h$ , on the anticipated seasonal quantity of lemons going to products,  $\hat{q}_{js}^h$ , on the quantity of fresh lemons purchased in preceding time period,  $q_{f(t-1)}^h$ , and on other variables  $z_{1t}, \dots, z_{kt}$ . The relation is assumed to be stochastic, the additive random disturbance  $v_{1t}$ , specified as above, completing the description.

$$\text{Fresh: } q_{ft}^{dh} = h^2(p_{ft}^h, \hat{q}_{js}^h, q_{f(t-1)}^h, z_{1t}, \dots, z_{kt}) + v_{1t} \quad (3)$$

The handlers' primary decision variable is taken to be the quantity to be sold fresh. Their supply behavior for time unit  $t$  is represented by the simple function:

$$q_{ft}^h = s^h(p_{f(t-k)}^h, \bar{q}_{fs}^h) + v_t \quad (4)$$

in which  $\bar{q}_{fs}^h$  is the planned season quantity to be sold fresh,  $p_{f(t-k)}^h$  is the price actually realized in time unit  $t-k$  ( $k$  a small positive integer), and  $v_t$  is a random disturbance. The difference between the quantity actually sold fresh during the season,  $\sum_{t \in S} q_{ft}^h$ , and the planned quantity is assumed to be small enough to be neglected. We further assume that the difference between the averages of  $p_{ft}^h$  and  $p_{f(t-k)}^h$  over a season is negligible. This leads us to write for the season aggregate demand function facing handlers:

$$\text{Fresh: } p_{fs}^h = H(q_{fs}, q_{js}, z_{1s}, \dots, z_{ks}) + v_s \quad (5)$$

in which all of the variables are either averages or sums over the time units constituting a season.

3. Demand Functions for Fresh Lemons at Grower Level.--The demand function (5) of wholesalers is reduced to the grower level ("on-tree" basis) by subtracting from the "wholesale" price the average outlays per box during the season for picking, hauling, packing, and selling. Thus the season aggregate demand function facing growers may be written as:

$$\text{Fresh: } p_{fs}^0 = H(Q_{fs}, P_{js}, Z_{ls}, \dots, Z_{ks}) + V_s \quad (6)$$

in which  $p_{fs}^0 = p_{fs}^h - \bar{c}_{hs}$ ; the second term on the right represents the average costs enumerated above. This representation assigns handlers (as distinct from growers) a neutral role as economic agents. Maximization of net returns to handlers is not deemed to be a rational objective in this context. Thus our procedure does not imply restrictions on handlers' cost functions. In particular, we do not need to assume that the handlers' unit variable costs are fixed.

#### Empiricizing the Functions

In obtaining numerical estimates of the parameters of the functions (1), (2), (5), and (6), some new constraints had to be introduced and some compromises had to be made to conform to available data. Throughout we have used functions linear in the parameters and disturbances; in fact, linear in all variables except income. At the handler and grower levels, functions comparable to (5) and (6) were fitted for the six-month periods November-April and May-October of each marketing year separately, retaining the distinction established in earlier studies between "winter" and "summer" lemons.<sup>1/</sup> Our estimates refer to undeflated prices and income (current dollars) and to total rather than per caput quantities and income. The effects of population increase and of other factors that shift aggregate demand smoothly over time are netted out by means of a trend variable attached to every fitted equation. General price level influences are, of course, reflected in the income variable

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<sup>1/</sup> G. M. Kuznets and Lawrence R. Klein, A Statistical Analysis of the Domestic Demand for Lemons, 1921-1941, University of California, Giannini Foundation Mimeographed Report No. 84 (Berkeley, 1943), 112p.

measured in current dollars and the estimates of the coefficients of this variable also carry the effect of price level changes.<sup>1/</sup>

Estimates of consumer purchases of fresh lemons and of lemon products (canned lemon juice and frozen concentrated lemonade) and of prices paid by consumers are available for the period June, 1951, to September, 1959.<sup>2/</sup> These estimates are derived from purchase and price data reported weekly by a national panel of households established by the Market Research Corporation of America. The nationwide consumer panel was substantially enlarged in 1954 and the old series adjusted to the level indicated by the expanded panel beginning with October, 1952. Thus comparable series are available only from the latter date. For "winter" lemons we include the seven-month set October-April, beginning with October, 1952, and ending with April, 1959 (Table VI-1); for "summer" lemons we have used a five-month set, May-September, beginning with May, 1953, and ending with September, 1959 (Table VI-2).

It should be noted that the variability of the price series for the periods considered, particularly of prices of fresh lemons, is quite small. As can be seen from the tabulation below, the coefficient of variation of prices paid by households for fresh lemons is somewhat under 4 percent for both winter and summer months. Small variability for this period is also shown by retail prices of fresh lemons collected by BLS (coefficients of variation are 4.3 and 5.3 percent for winter and summer lemons, respectively), the only other country-wide retail price series that is available.<sup>3/</sup> The absence of substantial swings of prices during the postwar period we are considering may make it difficult to measure properly price effects.

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<sup>1/</sup> The common practice of deflating prices and income by some index of prices appears to be also motivated by the desire to ensure that the empirical demand function would be homogeneous of zero degree in prices and income in conformance to theoretical specification. This objective can be accomplished by using as a deflator any price series or, for that matter, any random or haphazard selection of individual prices.

<sup>2/</sup> Monthly data for fresh lemons and canned lemon juice (in case units) are available from the same source, beginning with January, 1949.

<sup>3/</sup> BLS began pricing fresh lemons in May, 1953, and frozen concentrated lemonade in May, 1960. Table VI-5 reproduces the monthly BLS prices of fresh lemons for the relevant period.

TABLE VI-1  
Variables Used in the Winter Lemon Analysis at the Retail Level

Season and month		Household purchases of fresh lemons	Household purchases of frozen lemonade	Household purchases of lemon juice	Price of fresh lemons	Price of frozen concentrated lemonade	Price of canned lemon juice
		1 thousand boxes	2 thousand gallons	3 thousand cases 24 No. 2	4 cents per dozen	5 cents per 6-ounce can	6 cents per $\frac{1}{2}$ -ounce can
1952-53	October	219	167	46	45.7	17.6	11.6
	November	193	115	41	45.3	17.0	11.5
	December	199	80	35	46.4	17.0	11.7
	January	220	80	40	46.3	17.3	11.6
	February	229	94	32	47.2	17.0	11.9
	March	240	116	38	45.9	16.9	11.6
	April	254	159	35	43.8	17.1	11.9
1953-54	October	274	267	45	45.8	17.2	12.3
	November	213	162	39	46.6	18.4	12.4
	December	232	102	37	47.0	17.5	12.3
	January	223	121	40	47.5	17.5	12.4
	February	246	114	36	46.0	18.9	12.5
	March	278	139	43	45.8	17.4	12.5
	April	321	230	50	43.8	17.3	12.4
1954-55	October	252	244	50	45.1	15.7	12.9
	November	225	167	43	46.8	15.4	12.2
	December	243	127	41	45.0	16.0	12.8
	January	234	121	47	46.2	16.2	12.7
	February	251	136	45	44.0	15.9	13.0
	March	252	194	43	42.9	15.5	12.5
	April	307	321	47	41.3	15.3	12.5
1955-56	October	228	230	34	43.9	14.0	12.1
	November	207	174	32	45.5	14.0	12.3
	December	216	147	31	46.8	14.3	12.6
	January	218	153	34	48.1	14.8	12.4
	February	242	163	37	46.3	14.8	12.6
	March	261	177	40	44.6	14.7	12.2
	April	288	273	44	42.5	14.2	12.5

(Continued on next page.)

Table VI-1 continued

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Season and month	Household purchases of fresh lemons		Household purchases of frozen lemonade		Household purchases of lemon juice		Price of fresh lemons cents per dozen	Price of frozen concentrated lemonade cents per 6-ounce can	Price of canned lemon juice cents per $\frac{1}{2}$ -ounce can
	1 thousand boxes	2 thousand gallons	3 thousand cases 24 No. 2	4					
				5					
1956-57	October	248	350	49	46.2	13.4	12.1		
	November	232	148	42	47.5	14.3	11.7		
	December	223	166	47	47.4	14.1	12.6		
	January	217	176	45	50.1	14.9	12.6		
	February	220	161	38	49.1	14.4	12.6		
	March	239	280	48	46.2	13.4	12.3		
	April	285	368	48	43.2	12.4	10.9		
1957-58	October	259	415	48	44.1	11.5	11.1		
	November	226	228	45	47.1	12.0	10.3		
	December	243	203	50	46.6	12.9	10.3		
	January	261	181	37	46.9	12.9	10.0		
	February	242	191	47	47.8	12.7	11.1		
	March	251	216	54	46.5	12.6	11.0		
	April	295	434	55	45.2	11.4	10.4		
1958-59	October	248	467	59	43.9	11.0	9.7		
	November	201	236	43	45.2	11.3	9.8		
	December	203	192	53	45.2	11.9	9.8		
	January	189	171	51	45.7	12.6	9.8		
	February	220	169	51	45.7	12.0	9.7		
	March	227	261	52	43.9	11.8	11.5		
	April	296	528	56	42.4	11.2	10.4		

Source: U. S. Department of Agriculture, Consumer Purchases of Fruits and Juices (Washington: monthly issues).

TABLE VI-2  
Variables Used in the Summer Lemon Analysis at the Retail Level

Season and month	Household purchases of fresh lemons	Household purchases of frozen lemonade	Household purchases of lemon juice	Price of fresh lemons	Price of frozen concentrated lemonade	Price of canned lemon juice	Mean maximum temperature
	1 thousand boxes	2 million gallons	3 thousand cases 24 No. 2	4 cents per dozen	5 cents per 6-ounce can	6 cents per 5½-ounce can	7 degrees F.
1953	May	322	0.35	49	42.7	16.7	12.0
	June	575	1.10	112	45.6	16.7	11.9
	July	616	1.63	140	46.8	17.0	11.7
	August	552	1.20	106	43.4	17.3	11.8
	September	351	0.76	74	48.0	17.6	12.3
1954	May	352	0.51	57	43.7	16.5	12.1
	June	706	1.64	111	44.1	16.2	12.3
	July	738	1.77	110	42.7	15.9	12.8
	August	545	1.17	93	42.5	15.7	12.7
	September	352	0.53	56	43.2	15.1	12.8
1955	May	407	0.89	73	41.9	14.3	12.6
	June	587	1.55	83	40.4	14.0	12.1
	July	754	2.49	136	41.8	13.6	12.1
	August	610	2.18	96	41.6	13.9	11.7
	September	337	0.72	46	42.7	13.3	12.3
1956	May	416	0.64	65	40.2	13.8	12.0
	June	573	1.94	116	44.0	13.6	11.7
	July	563	1.97	106	44.6	13.3	12.2
	August	457	1.61	87	43.9	13.1	11.8
	September	309	0.65	61	45.8	13.3	12.1
1957	May	359	1.01	63	43.3	11.9	10.7
	June	472	2.23	105	41.7	11.0	11.0
	July	642	2.93	108	40.8	11.1	10.4
	August	508	2.31	87	42.5	10.9	10.8
	September	327	0.73	55	43.6	10.9	10.3

(Continued on next page.)

Table VI-2 continued

Season and month	Household purchases of fresh lemons	Household purchases of frozen lemonade	Household purchases of lemon juice	Price of fresh lemons	Price of frozen concentrated lemonade	Price of canned lemon juice	Mean maximum temperature
	1	2	3	4	5	6	7
	thousand boxes	million gallons	thousand cases 24 No. 2	cents per dozen	cents per 6-ounce can	cents per 5½-ounce can	degrees F.
1958	May	363	1.12	68	44.6	10.8	71.5
	June	508	2.05	84	42.7	10.3	78.0
	July	585	2.79	113	42.7	10.3	84.1
	August	538	2.65	88	42.0	10.4	83.7
	September	317	0.97	65	42.8	10.2	77.0
1959	May	393	1.47	99	42.3	10.7	75.8
	June	484	2.49	93	42.3	10.5	81.9
	July	530	2.71	125	42.2	10.4	84.7
	August	484	2.78	109	43.4	10.6	86.2
	September	335	1.23	99	43.9	10.9	79.9

Sources:

Cols. 1-6: U.S.D.A., Consumer Purchases of Fruits and Juices. Monthly.

Col. 7: Special tabulation from Marketing Research Department, Sunkist Growers, Inc.

Coefficients of Variation of Prices and Quantities at Retail Level  
Monthly Data, 1952-53 through 1958-59

Products	October-April		May-September	
	Prices	Quantities	Prices	Quantities
	percent			
Fresh lemons	3.8	12.2	3.8	26.1
Lemonade	15.0	48.3	18.5	28.8
Juice	8.4	15.5	7.4	27.4

Since at the retail level we are dealing with monthly observations, 0-1 indicator variables were introduced in the equations to allow for the existence of a seasonal pattern of demand. This is a restrictive formulation which limits the expression of the intraseasonal movement of demand to shifts in level but not in slope. It must be admitted that the use of proxy monthly variables is not analytically enlightening; at best, a seasonal pattern is established without any indication as to what might have generated this pattern and what factors affect it. The danger is that the seasonal variables will "explain" too much; that is, account for the major part of variation in the data without revealing anything about the underlying mechanism.

Because the retail level equations cover a time span of only five or six years, consumer income does not appear explicitly as a demand shifter in these equations. Expenditure on lemons (in all forms) is only a minor item in the consumer's food budget; it appears unlikely that demand for lemons responds to minor short-run (monthly) fluctuations of income around a pronounced upward trend characterizing this brief span of years. The effect, if any, of this upward movement is included in the trend variable present in all equations. We note also that a measure of (minimum) temperatures is not carried in the equations relating to winter months. While there is some statistical evidence that the demand for lemons may be affected by temperature in the winter, the substantive evidence for it has not been particularly impressive.<sup>1/</sup> The use of temperature variable in the winter equations would have resulted in a substantial reduction in the number of months that could have been included, and this loss of information was not deemed justified.

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<sup>1/</sup> Winter temperature as a demand shifter during winter months was first introduced in Kuznets and Klein, *op. cit.*, and an attempt was made to relate it to incidence of respiratory ailments for which hot lemonade is a commonly used palliative. This attempt was not successful.

The equations fitted to data at the retail level are thus of the following form:

$$\text{Winter: } q_{\text{hit}}^r = A_0 + \sum_{h=1}^3 A_h p_{\text{hit}}^r + A_4 t + \sum_{j=5}^{10} A_j M_{ij} \quad (7a-c)$$

$t \in 1953-54 \text{ to } 1958-59$

$i \in 5 - 10 \text{ (October-April)}$

$$\text{Summer: } q_{\text{hit}}^r = B_0 + \sum_{h=1}^3 B_h p_{\text{hit}}^r + B_4 t + B_5 F_{it} + \sum_{j=6}^9 B_j M_{ij} \quad (8a-c)$$

$t \in 1953-1959$

$i \in 6 - 9 \text{ (May-September)}$

In both sets of equations  $h = 1, 2, 3$  refers, respectively, to fresh lemons, frozen concentrated lemonade, and lemon juice;  $q$ 's to quantities purchased by households (institutional consumption excluded);  $p$ 's to prices paid; and  $t$  to time trend. For the monthly factors,  $M_{ij} = 1$  if  $i = j$ , and zero otherwise. In the equations relating to the summer months, a temperature variable,  $F_i$ , (average maximum monthly temperature in some 22 cities) is also carried.

Equations at the handler and grower levels refer to a six-month period as a time unit (November-April and May-October for "winter" and "summer" lemons, respectively) and cover the years 1929-1941 and 1947-1959, omitting the war years 1942-1945 and the first postwar year, 1946. The data used in these analyses are shown in Tables VI-3 and VI-4.

The  $Z$  variables of functions (5) and (6) consist of disposable income and linear trend for both winter and summer lemons and of mean maximum temperature in the summer equations. As the price variable for fresh lemons at the handler level, we have used the average of prices received by Sunkist Growers for all lemons sold fresh, adjusted to an f.o.b. basis.<sup>1/</sup> This is the only available price series which encompasses the whole period of years under consideration. Table VI-6 provides a comparison of Sunkist f.o.b.-basis prices and some available estimates of industry f.o.b. prices. In Figure 1, we plot as time series the Sunkist prices and simple averages for the winter and summer periods of USDA monthly estimates of industry f.o.b.

<sup>1/</sup> This price series includes sales for export. However, the effect of excluding exports from the overall average price is not likely to be numerically significant.

TABLE VI-3

Variables Used in the F.O.B. Price Analysis for Winter Lemons

Year (November- April)	California- Arizona f.o.b. price of fresh lemons	Estimated California- Arizona on- tree price of fresh lemons	Domestic supply of fresh lemons  thousand boxes	Consumer purchases of lemon juice products  thousand equivalent boxes	Consumer purchases of domestic lemon juice products  thousand equivalent boxes	Imports for consumption of concentrated lemon juice  billion dollars	United States disposable personal income  billion dollars
	1	2					
	dollars per equivalent box	thousand boxes					
1929-30	4.94	3.47	2,169	0	0	0	75.8
1930-31	3.09	1.64	2,077	0	0	0	65.6
1931-32	2.49	1.09	2,020	0	0	0	51.2
1932-33	3.09	1.83	1,832	0	0	0	46.2
1933-34	3.20	1.95	2,081	0	0	0	50.9
1934-35	2.18	0.92	2,612	0	0	0	57.3
1935-36	3.75	2.45	2,386	0	0	0	64.9
1936-37	3.82	2.40	2,567	0	0	0	70.2
1937-38	3.49	2.13	2,329	0	0	0	66.6
1938-39	2.51	1.15	2,491	0	0	0	69.7
1939-40	2.99	1.66	2,746	0	0	0	75.1
1940-41	2.43	1.06	3,013	0	0	0	90.2
1946-47	4.89	2.57	3,160	226 <sup>a</sup> /	226 <sup>a</sup> /	0	168.5
1947-48	4.78	2.29	3,044	226 <sup>a</sup> /	226 <sup>a</sup> /	0	186.1
1948-49	6.49	3.89	2,921	226 <sup>a</sup> /	226 <sup>a</sup> /	0	189.6
1949-50	6.85	4.29	2,697	226	151	75	204.7
1950-51	5.82	3.17	2,777	248	223	25	224.2
1951-52	6.06	3.36	2,876	467	364	103	236.8
1952-53	5.93	3.32	2,803	449	398	51	250.2
1953-54	6.10	3.60	2,801	518	287	231	256.1
1954-55	5.67	3.07	2,853	531	334	197	271.5
1955-56	5.81	3.13	2,859	483	246	237	289.9
1956-57	5.82	3.14	2,750	368	208	360	306.1
1957-58	4.92	2.24	2,781	605	552	53	316.4
1958-59	5.16	2.50	2,737	646	644	2	334.1

<sup>a</sup>/ Estimated.

(Continued on next page.)

Table VI-3 continued

Sources:

Cols. 1-6: Same as for Columns 1-5 of Table 4.

Col. 7: The figures shown are two-year averages of calendar year United States disposable personal income as given in U.S.D.C., Survey of Current Business, July, 1961, and earlier issues.

TABLE VI-4

Variables Used in the F.O.B. Price Analysis for Summer Lemons

Year (May- October)	Estimated California- Arizona f.o.b. price of fresh lemons	California- Arizona on-tree price of fresh lemons	Domestic supply of fresh lemons	Consumer purchases of lemon juice products	Consumer purchases of domestic lemon juice products	Imports for consumption of con- centrated lemon juice	United States disposable personal income	Average maximum tempera- ture, May- September
	1	2		3	4	5	6	7
	dollars per equivalent box			hundred thousand equivalent boxes			billion dollars	degrees F.
1929	5.36	3.90	35.5	0	0	0	83.1	78.7
1930	5.18	3.71	38.8	0	0	0	74.4	81.2
1931	4.50	3.05	39.9	0	0	0	63.8	80.7
1932	4.41	3.01	31.2	0	0	0	48.7	80.2
1933	3.60	2.34	35.4	0	0	0	45.7	81.1
1934	3.85	2.60	40.6	0	0	0	52.0	82.3
1935	3.39	2.13	41.5	0	0	0	58.3	78.7
1936	4.49	3.19	43.1	0	0	0	66.2	81.4
1937	4.87	3.45	38.7	0	0	0	71.0	80.1
1938	2.82	1.46	43.5	0	0	0	65.7	79.8
1939	3.07	1.71	47.0	0	0	0	70.4	80.9
1940	3.04	1.71	46.1	0	0	0	76.1	78.8
1941	3.19	1.82	55.0	0	0	0	93.0	81.1
1947	5.65	3.33	56.4	5.2 <sup>a/</sup>	5.2 <sup>a/</sup>	0	170.1	79.6
1948	5.89	3.40	53.6	5.2 <sup>a/</sup>	5.2 <sup>a/</sup>	b/	189.3	80.2
1949	7.34	4.74	50.8	5.2	4.6	0.5	189.7	82.1
1950	5.55	2.99	45.8	6.0	3.5	2.5	207.7	79.1
1951	5.88	3.23	50.4	10.0	7.8	2.2	227.5	81.0
1952	6.67	3.97	49.9	18.2	16.5	1.7	238.7	82.4
1953	6.52	3.91	48.7	21.1	15.9	5.2	252.5	82.5
1954	5.75	3.25	49.1	18.8	12.8	6.0	256.9	81.1
1955	5.47	2.87	46.8	23.2	16.9	6.3	274.4	82.6
1956	6.05	3.37	44.1	20.8	14.2	6.6	292.9	80.1
1957	4.82	2.14	46.0	25.8	24.2	1.6	308.8	81.3
1958	4.92	2.24	42.6	26.1	26.1	b/	317.9	79.2
1959	5.38	2.72	44.5	30.2	24.5	5.7	337.3	82.0

(Continued on next page.)

Table VI-4 continued

a/ Estimated.

b/ Less than 50,000 boxes.

Sources:

- Col. 1: Data from 1935 on are from Sunkist Growers, Statistical Information, 1961, Table 11, p. 14; data for earlier years, from earlier issues. These are f.o.b. prices received for fresh lemons marketed by Sunkist Growers.
- Col. 2: F.o.b. prices for fresh lemons, as shown in Column 1, minus average November-October picking, hauling, packing, and selling costs as given in Statistical Information, 1961, Table 12, p. 15, and earlier issues.
- Col. 3: Industry fresh lemon shipments, minus exports of fresh lemons (including exports to Canada), plus imports of fresh lemons for consumption. Monthly fresh lemon shipments from Sunkist Growers, Annual Report, annual issues. Monthly exports, which also include fresh limes, from U.S.D.C., Monthly Summary of Foreign Commerce of U.S. Monthly imports of fresh lemons from U.S.D.C., United States Imports of Merchandise for Consumption.
- Col. 4: U.S.D.A., Consumer Purchases of Selected Fruit and Juices, monthly. Includes consumer purchases of lemon juice and frozen concentrated orange juice. The figures shown are 6-month aggregates of 4-week (28-day) periods; that is, include data for 24, rather than the full 26, weeks. Publication of monthly estimates of consumer purchases of lemon products discontinued in September, 1959. The seasonal total for that year includes estimated purchases for October, 1959.
- Col. 5: Column 4 minus Column 6.
- Col. 6: U.S.D.C., United States Imports of Merchandise for Consumption, monthly, converted from gallons to tons, using 75 gallons per ton. Conversion from tons to equivalent boxes of fresh fruit is at 25.375 boxes per ton for the years 1949-1954 and at 26.3 boxes per ton for subsequent years.
- Col. 7: U.S.D.C., Survey of Current Business, July, 1961, and earlier issues. The figures shown refer to calendar year disposable personal income.
- Col. 8: Statistical Information, 1961, and earlier issues.

TABLE VI-5  
Monthly Retail Prices of Fresh Lemons  
BLS Estimates

Years	January	Febru-	March	April	May	June	July	August	Septem-	October	Novem-	Decem-
		ary										
1953					18.6	18.9	20.0	18.9	22.5	19.8	19.5	19.5
1954	19.0	18.7	18.3	18.0	18.4	17.6	18.0	17.5	17.4	18.5	18.8	18.5
1955	18.7	18.5	18.1	18.3	18.0	17.5	17.4	17.5	17.8	17.5	18.0	19.0
1956	19.4	18.4	17.8	17.8	17.6	17.5	19.0	18.7	19.8	20.1	20.4	20.5
1957	21.0	21.0	19.7	19.0	19.3	18.2	17.8	18.1	18.0	17.8	19.3	19.4
1958	19.3	18.8	19.0	18.8	19.1	18.3	17.9	17.8	18.0	18.3	18.5	18.8
1959	19.5	19.1	18.9	18.7	18.4	18.1	17.9	17.9	19.3	19.5	19.8	19.7

Source: U. S. Department of Labor, Bureau of Labor Statistics, Retail Prices of Food (biennially).

TABLE VI-6  
Comparison of F.O.B. Price Series for Winter and Summer Lemons

Year	Winter lemons			Summer lemons		
	Sunkist Growers California- Arizona f.o.b. price	U. S. Department of Agriculture packed f.o.b. price for Cali- fornia lemons	Lemon Administra- tive Committee domestic weighted average f.o.b. price	Sunkist Growers California- Arizona f.o.b. price	U. S. Department of Agriculture packed f.o.b. price for Cali- fornia lemons	Lemon Administra- tive Committee domestic weighted average f.o.b. price
	1	2	3	4	5	6
dollars per equivalent box						
1959-60	4.88	5.08	5.46	5.34	5.65	5.76
1958-59	5.16	5.18	5.46	5.38	5.54	5.80
1957-58	4.92	4.92	5.36	4.92	4.82	5.42
1956-57	5.82	5.97		4.82	4.81	
1955-56	5.81	6.12		6.05	6.19	
1954-55	5.67	5.72		5.47	5.42	
1953-54	6.10	6.12		5.75	5.83	
1952-53	5.93	5.91		6.52	6.54	
1951-52	6.06	5.96		6.67	6.32	
1950-51	5.82	5.85		5.88	5.97	
1949-50	6.85	7.58		5.55	5.28	
1948-49	6.49	6.54		7.34	7.35	
1947-48	4.78	4.80		5.89	5.98	
1946-47	4.89	5.11		5.65	5.57	
1940-41	2.43	2.48		3.19	3.22	
1939-40	2.99	3.10		3.04	3.03	
1938-39	2.51	2.60		3.07	3.30	
1937-38	3.49	3.84		2.82	2.81	

Sources:

Cols. 1 and 4: Sunkist Growers, Inc., Statistical Information on the Citrus Fruit Industry, August, 1961, Table 11, p. 14.

Cols. 2 and 5: Unweighted averages of monthly prices shown in U.S.D.A. Citrus Prices, Supplement No. 3 to Agricultural Prices, November, 1952, and subsequent supplements.

Cols. 3 and 6: Lemon Administrative Committee, Weekly Newsletter.

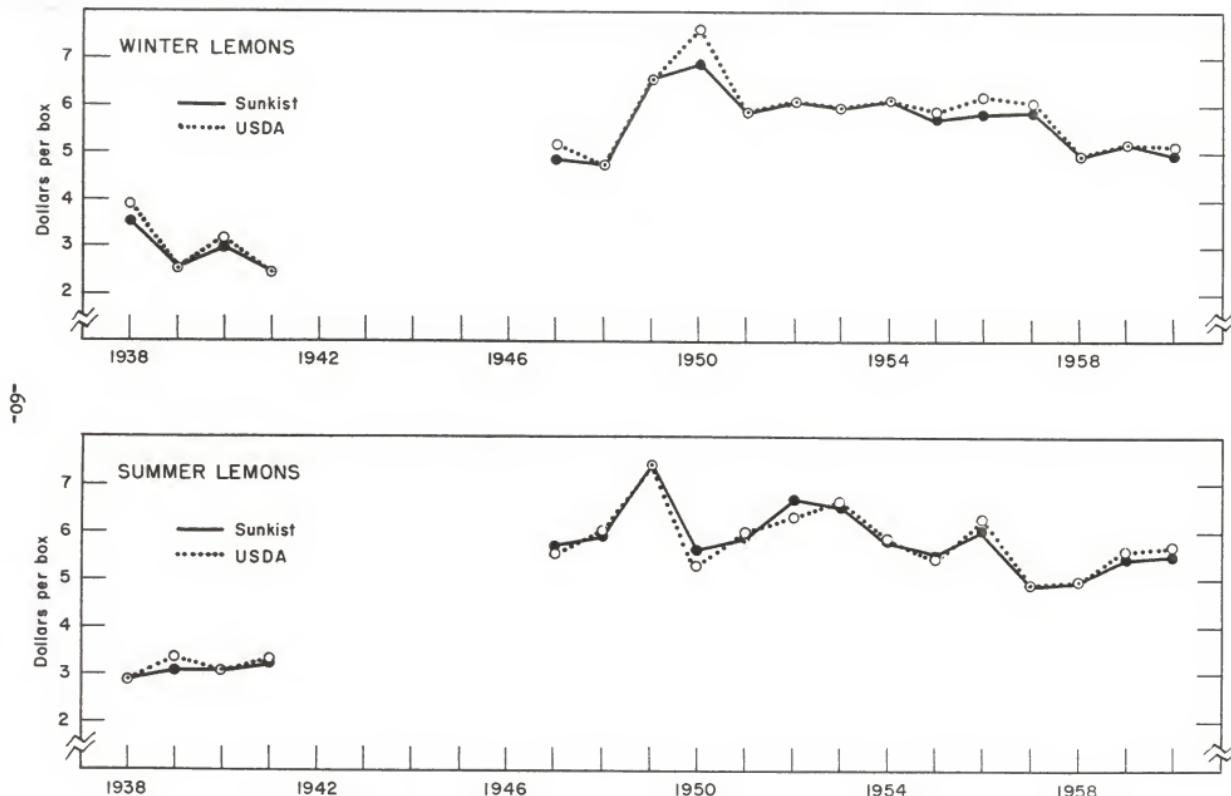


Figure 1: Comparison of Average Prices, F.O.B. Basis, Received by Sunkist Growers and Averages of U.S.D.A. Monthly Estimates of Industry F.O.B. Prices

prices which presumably refer to f.o.b. sales of packed lemons. As can be noted by scanning the chart, the agreement between the two series is excellent, except for one or two years of the 18 for which a comparison is possible and relevant.

To obtain a sharper measurement of the effect of processed lemons on the demand for fresh, the aggregate of actual quantities of lemons purchased by consumers in the form of lemon juice and frozen concentrated lemonade was substituted in the empirical equations for the quantity of lemons shipped to products during the winter and summer periods. This made it possible to reflect more adequately the fact that only in the 1950's did lemon juice and frozen concentrated lemonade become significant outlets for lemons not sold fresh. The available data on movement of lemons to products in interwar years attenuates the sharp difference in utilization between the two periods largely because the published estimates include shipments of lemons that were not actually processed, although growers received payment for the quantity thus diverted.

In order to assess the effects of imports of lemon juice on fresh lemon prices, imports for consumption during the months October-March and April-September were introduced in the winter and summer lemon equations, respectively, as separate "explanatory" variables. To avoid double counting, imports were subtracted from the aggregate quantities of lemon juice products purchased by households to approximate purchases of domestic juice products. This was retained as the other "explanatory" lemon-products variable. It cannot be argued that this partition of total household purchases of lemon juice products into domestically produced and imported components is completely accurate since data are not available either on the timing or the form of utilization of imported concentrated lemon juice, a significant proportion of which might have gone into institutional consumption. It seems certain, however, that the failure to adjust household purchases for imports would produce a more serious error (due to double counting) than the inaccuracies implicit in the procedure followed.

The equations fitted at the handler and grower levels are thus of the following form:

$$\text{Winter: } p_f^s = A_0 + A_1 q_f + A_2 q_j + A_3 (\log_{10} I) + A_4 t$$

$$p_f^s = A_0 + A_1 q_f + A_2 q_{jd} + A'_2 q_{jo} + A_3 (\log_{10} I) + A_4 t$$

$$\text{Summer: } p_f^s = B_0 + B_1 q_f + B_2 q_j + B_3 (\log_{10} I) + B_4 F + B_5 t$$

$$p_f^s = B_0 + B_1 q_f + B_2 q_{jd} + B_2' q_{jo} + B_3 (\log_{10} I) + B_4 F + B_5 t$$

in which the superscript s = h, g denotes the marketing level (handler, grower); the subscripts f and j refer, respectively, to fresh and juice products (the secondary affixes d and o referring to a breakdown of the latter into domestic and "other" or imports); p's and q's refer to prices and quantities, respectively; I to disposable personal income; F to average monthly maximum temperature in May-September; and t to a linear trend component.

#### Statistical Results

In the tabulation given below, we present the estimated regression equations for three marketing levels. These equations were fitted by least squares to data shown in Tables VI-1 to VI-4 and the variables are therefore in the units specified in these tables. The numbers shown in parentheses below the coefficients in each equation are estimated standard errors of these coefficients. Quantity and price residuals relating to the various equations are set out in Tables VI-7 to VI-10 and are graphed as time series in Figures 2 to 5. The tables of residuals also show, wherever appropriate, the Durbin-Watson d statistic for testing serial dependence in residuals. In no case tested did we find any evidence of serial correlation in residuals.

The results at the retail level for both winter and summer lemons are dominated by the monthly seasonal factors. These variables and the trend factor account for most of the "explained" variability of consumer purchases of fresh lemons, frozen concentrated lemonade, and lemon juice in the months October through April. Temperature is an important determining variable, in addition to the seasonal and trend factors, in accounting for the variability of household purchases of lemons and lemon products during the summer months. Price variables do not appear to be particularly effective in any of the equations at the retail level. This finding is not unexpected, because, as was noted earlier, lemon prices exhibited only minor variability during the period under consideration. But even under those unfavorable conditions for measurement, the results are at least partly consistent with the hypothesis of competition in demand between fresh lemons and lemon juice products which entails

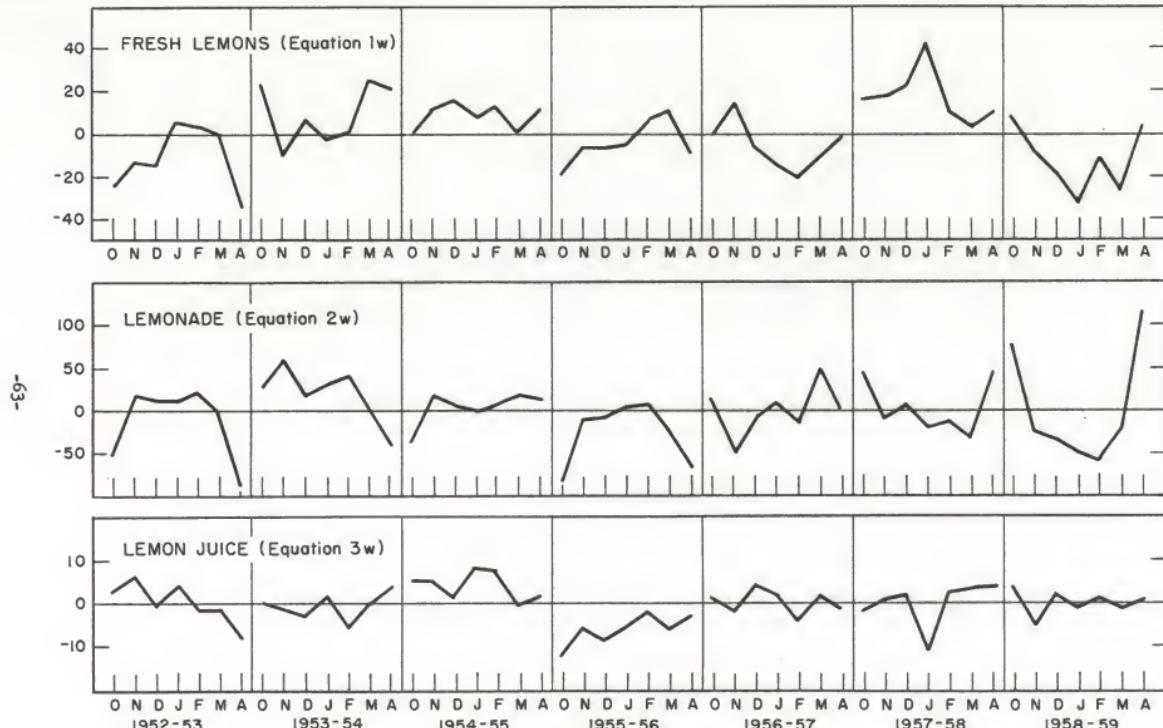


Figure 2: Winter Lemons. Monthly Quantity Residuals for Fresh Lemons, Frozen Concentrated Lemonade, and Lemon Juice Plotted as Time Series

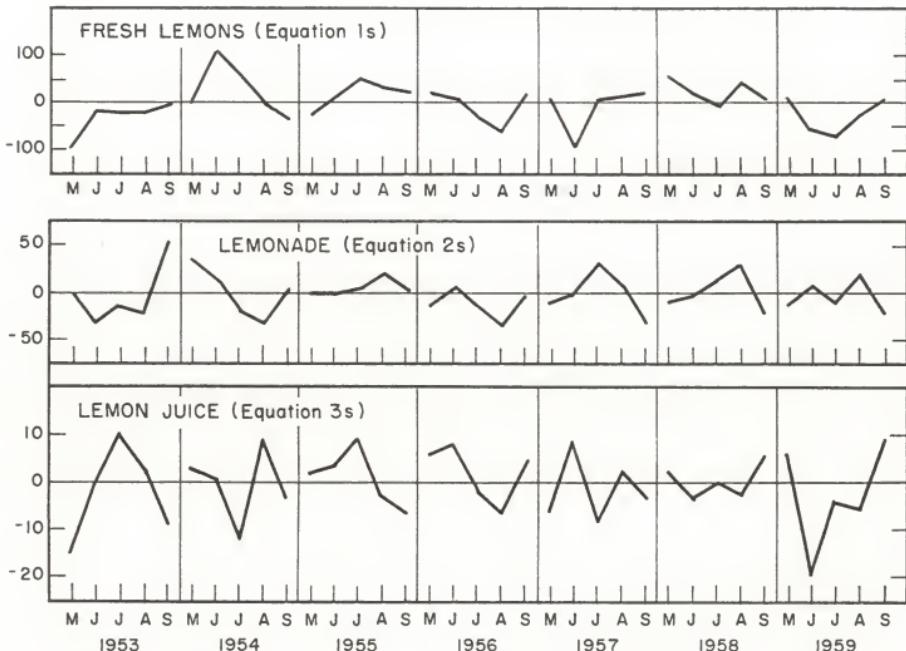


Figure 3: Summer Lemons. Monthly Quantity Residuals for Fresh Lemons, Frozen Concentrated Lemonade, and Lemon Juice Plotted as Time Series

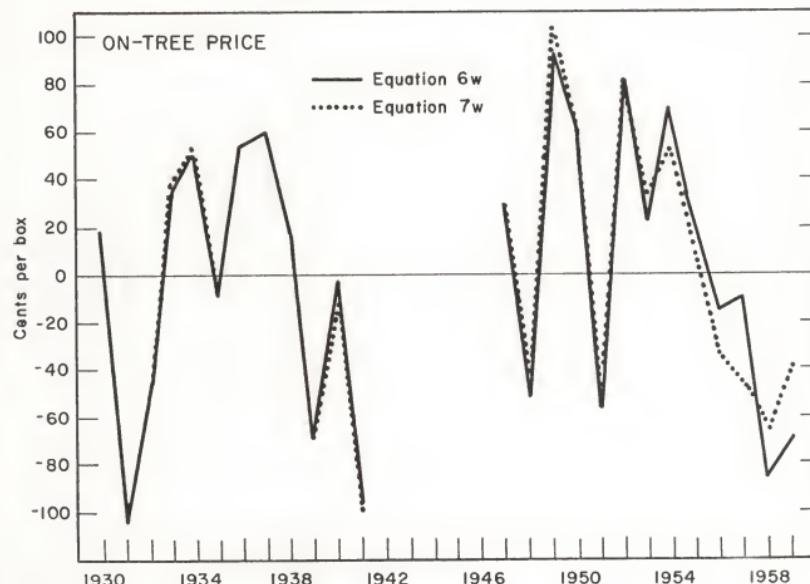
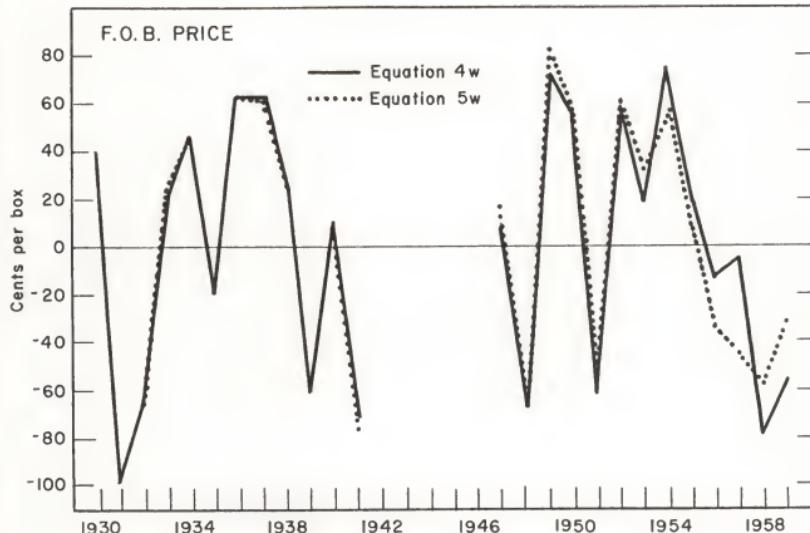


Figure 4: Winter Lemons. Price Residuals for Fresh Lemons  
Plotted as Time Series

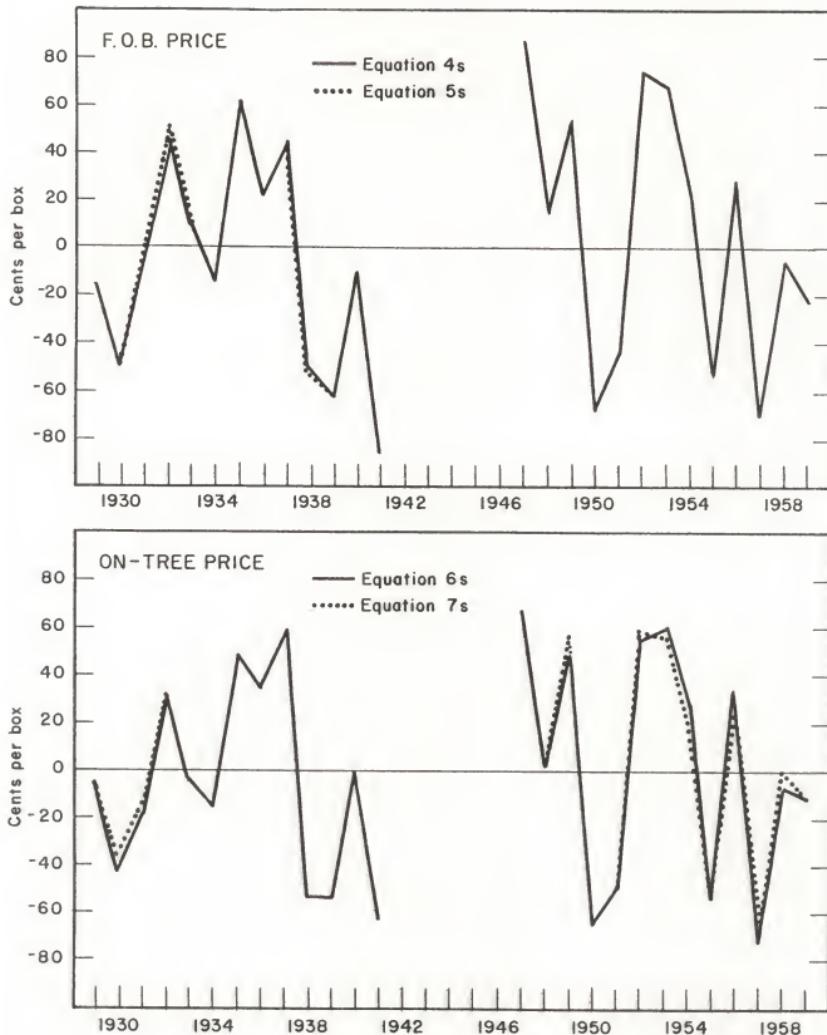


Figure 5: Summer Lemons. Price Residuals for Fresh Lemons  
Plotted as Time Series

positive magnitudes of coefficients of quantity on other prices. This criterion of signs is completely met in equations 4w, 1s, and 3s and only partially met by the remaining equations.

Much more definite results are obtained in the seasonal analyses at the handler and grower levels. A greater span of experience is encompassed by these equations which cover both the 1930's and the 1950's, and the effect of intraseasonal variability is greatly attenuated by aggregation over six-month periods. The f.o.b. and on-tree prices of winter and summer lemons are found to be adversely affected by volume of supplies of fresh lemons and by the quantities of lemon juice products purchased by households. The demand for fresh lemons during the summer months is affected by the level of prevailing temperatures. There is clear-cut evidence of a significant downward trend in the demand for fresh summer lemons during the period covered.

Equations 4w to 7w and 4s to 7s are entirely consistent with the hypothesis of competition in demand between fresh and products lemons and, in fact, suggest a very substantial impact of products on f.o.b. and on-tree prices of fresh lemons. A quantitative illustration of this impact is set out in the tabulation below.

The Average Net Effects on Price of Fresh Lemons Received by Handlers and Growers of an Increase of 100,000 Boxes

Season and marketing level	Quantity sold fresh	Quantity sold of juice products	Quantity of lemon juice imports
		cents per box	
<u>Winter</u>			
F.o.b.	-18	-52	-40
On-tree	-15	-44	-31
<u>Summer</u>			
F.o.b.	-10	-15	-14
On-tree	- 8	-11	- 9

We note that other factors remaining fixed, including quantity sold fresh, an increase in the volume of household purchases of juice products equivalent to 100,000 boxes of fresh lemons would, on the average, reduce the f.o.b. price

of fresh lemons by 52 cents per box in winter months (equation 4w) and by some 15 cents per box in summer months (equation 4s). Paradoxically, the average effects are larger than those associated with equivalent changes in the marketed volume of fresh lemons which amount to 18 cents and to 10 cents per box for winter and summer lemons, respectively. The net impact of household purchases of juice products on the on-tree price of fresh lemons is of a somewhat lesser absolute magnitude, but is larger relatively in comparison with the effect on the f.o.b. price. An increase in the former equivalent to 100,000 boxes is accompanied by a reduction of some 44 cents per box in the on-tree price of fresh winter lemons and of 10 cents per box for fresh lemons marketed during summer months.

Rather similar results are obtained when the quantities purchased by households are separated into domestically produced and imports. The coefficients of imports tend to be somewhat lower in absolute magnitude than the coefficients of domestic products in each equation, but the differences are not significant. For all practical purposes, imports and domestic products can be treated as identical in their impact on fresh lemon demand. Other factors remaining fixed, including quantity of domestic juice products sold, an increase in lemon juice imports equivalent to 100,000 boxes of fresh lemons results in a decrease in the f.o.b. price of winter lemons of some 40 cents per box and of 31 cents per box in the on-tree price to growers. Analogous average net effects are smaller for summer lemons, being 14 and 9 cents per box, respectively, for f.o.b. and on-tree prices.

Another way of representing the impact of products on demand for fresh lemons is shown in Figures 6 and 7 for winter and summer lemons. The major difference in the demand situations for fresh lemons in the 1930's and the 1950's can be accounted for largely by the combined effect of two factors: the very substantial increase in consumer income which shifted the demand for fresh lemons upward and the increasing consumer acceptance of lemon juice products which shifted the demand for fresh lemons downward. If we take the quinquennia 1937-1941 and 1955-1959 as the reference periods, the balance of the two counteracting factors turns out to have been clearly positive. The net price-quantity line for the second period is above the line of the first period for both winter and summer lemons and at both handler (f.o.b.) and grower (on-tree) levels.

The net price-quantity lines labeled (3) in all panels of Figures 6 and 7 were computed for the second reference period on the assumption that only the shift due to the increase in consumer income was effective; that is, as if consumer takings of lemon juice products were just as negligible in 1955-1959 as they were in 1937-1941. The difference in the levels of lines (2) and (3) then measures the downward pressure due to lemon products on demand for fresh lemons. The points of unit price flexibility at which gross revenue is maximized are shown on the charts, and in the tabulation below we compare the relative magnitudes of maximum returns from fresh lemons under the three sets of conditions. The depressing effect of lemon juice products on the optimum returns from fresh lemons is clearly very substantial.

Maximum Gross Returns from Fresh Lemons Under Three Conditions

Period	Winter lemons		Summer lemons	
	F.o.b.	On-tree	F.o.b.	On-tree
percent of period 1937-1941				
(1) 1937-1941	100	100	100	100
(2) 1955-1959	184	162	144	118
(3) 1955-1959, if no lemon juice products were available	298	291	264	245

It is appropriate to conclude this section by reviewing briefly the more important limitations of the analysis just described. We note first that the model we have used was made more tractable statistically by assuming that the sellers' decisions regarding price (at the retail level) or quantity (at the handler or grower level) were independent of the disturbances specified for these relations. While to some extent plausible, such assumptions are, in fact, only crude approximations. In this respect, the use of household purchases of lemon juice products in the f.o.b. and on-tree price equations in place of quantity of lemons sold to products has made the approximation less tenable, for it cannot be assumed that consumer purchases are uncorrelated with disturbances in the price equations. Thus it cannot be claimed that the least squares of coefficients we cite possess the usual optimum properties.

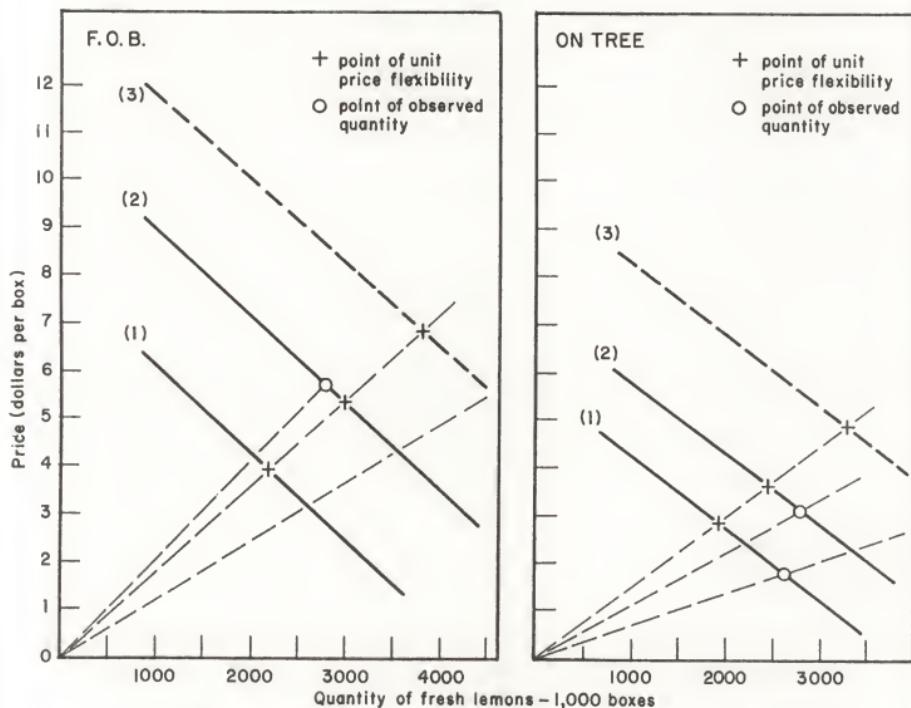


Figure 6: Winter Lemons. Net Price-Quantity Relations for Fresh Lemons Under Various Assumptions

	<u>F.O.B. Level</u>	<u>On-Tree Level</u>
(1) 1936-37 through 1940-41	$\hat{P}_f^h = 7.97 - 0.0018 q_f$	$\hat{P}_f^g = 5.76 - 0.0015 q_f$
(2) 1954-55 through 1958-59	$\hat{P}_f^h = 10.81 - 0.0018 q_f$	$\hat{P}_f^g = 7.32 - 0.0015 q_f$
(3) 1954-55 through 1958-59, zero lemon juice products	$\hat{P}_f^h = 13.75 - 0.0018 q_f$	$\hat{P}_f^g = 9.82 - 0.0015 q_f$

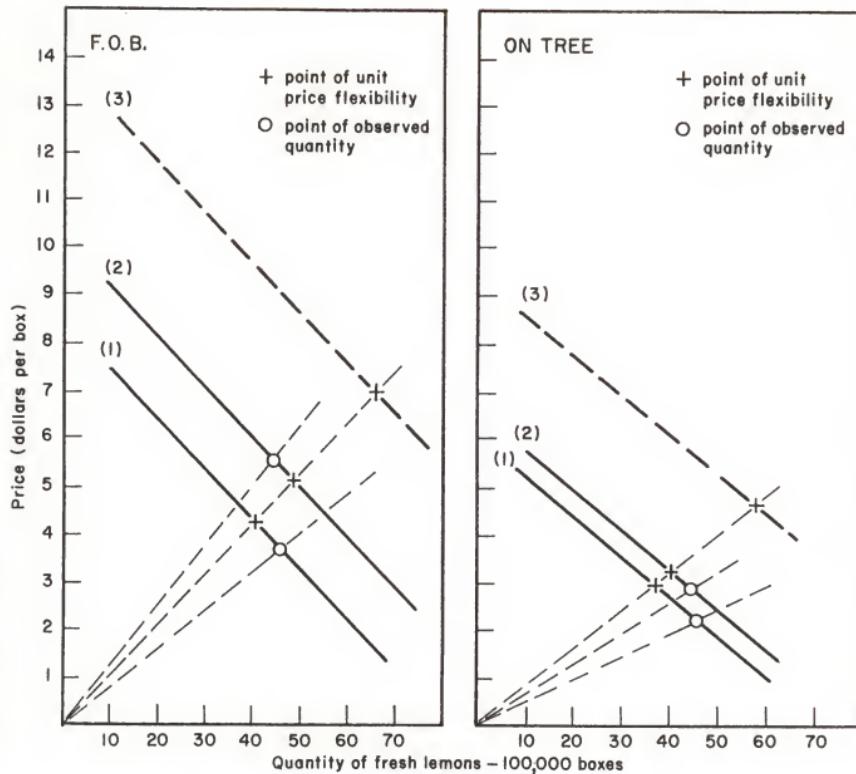


Figure 7: Summer Lemons. Net Price-Quantity Relations for Fresh Lemons Under Various Assumptions

	<u>F.O.B. Level</u>	<u>On-Tree Level</u>
(1) 1937-1941	$\hat{p}_f^h = 8.56 - 0.1049 q_f$	$\hat{p}_f^g = 5.94 - 0.0802 q_f$
(2) 1955-1959	$\hat{p}_f^h = 10.27 - 0.1049 q_f$	$\hat{p}_f^g = 6.45 - 0.0802 q_f$
(3) 1955-1959, zero lemon juice products	$\hat{p}_f^h = 13.92 - 0.1049 q_f$	$\hat{p}_f^g = 9.29 - 0.0802 q_f$

Turning to more substantive matters, attention once more must be drawn to the fact that our analysis was in effect restricted to the appraisal of the short-run effect of products on demand for fresh lemons. The markets for fresh and products lemons are interrelated and a more comprehensive analysis is required which would trace out all of the major lines of short-run and long-run influence. Such an analysis would provide a more valid basis for policy decisions than the present much more restricted study.

Least Squares Equations

Winter Lemons

I. Retail level; monthly, October-April, 1952-53 through 1958-59.

$$(1w) \hat{q}_{fm}^r = 157.79 - 0.3802 p_{fm}^r + 5.6149 p_{1m}^r + 3.8051 p_{jm}^r + 6.8870 t - \\ (0.220) \quad (4.367) \quad (3.621) \quad (4.523)$$

$$- 46.39 M_1 - 79.62 M_2 - 72.81 M_3 - 73.72 M_4 - 62.03 M_5 - \\ (10.27) \quad (11.88) \quad (11.97) \quad (13.58) \quad (12.49)$$

$$- 45.97 M_6 \quad R^2 = 0.717 \\ (10.51)$$

$$(2w) \hat{q}_{1m}^r = 398.01 - 1.0669 p_{fm}^r - 10.4712 p_{1m}^r + 4.5908 p_{jm}^r + 18.3250 t - \\ (5.422) \quad (10.664) \quad (8.842) \quad (11.044)$$

$$- 21.09 M_1 - 145.63 M_2 - 175.30 M_3 - 172.19 M_4 - 171.33 M_5 - \\ (25.09) \quad (29.01) \quad (29.22) \quad (33.15) \quad (30.51)$$

$$- 127.40 M_6 \quad R^2 = 0.853 \\ (25.66)$$

$$(3w) \hat{q}_{jm}^r = 27.84 - 0.2614 p_{fm}^r + 2.6298 p_{1m}^r - 1.9211 p_{jm}^r + 4.0930 t - \\ (0.622) \quad (1.223) \quad (1.014) \quad (1.266)$$

$$- 0.45 M_1 - 7.86 M_2 - 6.53 M_3 - 7.39 M_4 - 8.00 M_5 - 2.48 M_6 \\ (2.88) \quad (3.33) \quad (3.35) \quad (3.80) \quad (3.50) \quad (2.94)$$

$$R^2 = 0.584$$

II. Handler (f.o.b.) level; seasonal, 1929-30 through 1940-41 and 1946-47 through 1958-59.

$$(4w) \hat{p}_f^h = - 13.6295 - 0.0018 q_f - 0.0052 q_j + 11.5531 (\log I) - 0.0319 t \\ (0.0007) \quad (0.0023) \quad (2.063) \quad (0.0352)$$

$$R^2 = 0.843$$

$$(5w) \hat{p}_f^h = - 13.8921 - 0.0017 q_f - 0.0057 q_{jd} - 0.0040 q_{jo} + 11.4302 (\log I) - \\ (0.0007) \quad (0.0024) \quad (0.0026) \quad (2.075)$$

$$- 0.0329 t \quad R^2 = 0.849 \\ (0.0353)$$

III. Grower (on-tree) level; seasonal, 1929-30 through 1940-41 and 1946-47 through 1958-59.

$$(6w) \hat{p}_f^g = - 10.3085 - 0.0015 q_f - 0.0044 q_j + 8.4092 (\log I) - 0.0299 t \\ (0.0007) \quad (0.0021) \quad (1.933) \quad (0.0329)$$

$$R^2 = 0.662$$

$$(7w) \hat{p}_f^g = -10.6118 - 0.0015 q_f - 0.0050 q_{jd} - 0.0031 q_{jo} + \\ (0.0007) \quad (0.0022) \quad (0.0024) \\ + 8.4981 (\log I) - 0.0310 t \quad R^2 = 0.683 \\ (1.920) \quad (0.0327)$$

### Summer Lemons

I. Retail level; monthly, May-September, 1953 through 1959.

$$(1s) \hat{q}_{fm}^r = -230.14 - 10.9334 p_{fm}^r + 7.2561 p_{lm}^r + 4.5893 p_{jm}^r + \\ (6.944) \quad (15.527) \quad (18.738) \\ + 11.7153 F_m - 3.1430 t + 80.14 M_1 + 170.30 M_2 + 197.35 M_3 + \\ (4.620) \quad (16.561) \quad (40.98) \quad (31.63) \quad (43.59) \\ + 99.88 M_4 \quad R^2 = 0.895 \\ (40.51) \\ (2s) \hat{q}_{lm}^r = -4.045 + 0.0015 p_{fm}^r - 0.0766 p_{lm}^r - 0.0007 p_{jm}^r + 0.0672 F_m + \\ (0.034) \quad (0.075) \quad (0.091) \quad (0.022) \\ + 0.1080 t + 0.44 M_1 + 0.84 M_2 + 1.02 M_3 + 0.75 M_4 \\ (0.080) \quad (0.020) \quad (0.15) \quad (0.21) \quad (0.20) \\ R^2 = 0.933 \\ (3s) \hat{q}_{jm}^r = -474.82 + 1.7803 p_{fm}^r + 8.3237 p_{lm}^r - 4.3109 p_{jm}^r + 4.4984 F_m + \\ (1.180) \quad (2.638) \quad (3.183) \quad (0.785) \\ + 10.1609 t + 24.29 M_1 + 20.60 M_2 + 21.91 M_3 + 2.00 M_4 \\ (2.814) \quad (6.96) \quad (5.37) \quad (7.41) \quad (6.88) \\ R^2 = 0.919$$

II. Handler (f.o.b.) level; seasonal, 1929 through 1941 and 1947 through 1959.

$$(4s) \hat{p}_f^h = -46.229 - 0.1049 q_f - 0.1450 q_j + 10.5632 (\log I) + 0.4315 F - \\ (0.036) \quad (0.041) \quad (1.404) \quad (0.109) \\ - 0.0819 t \quad R^2 = 0.851 \\ (0.050) \\ (5s) \hat{p}_f^h = -46.163 - 0.1047 q_f - 0.1451 q_{jd} - 0.1432 q_{jo} + \\ (0.037) \quad (0.042) \quad (0.085) \\ + 10.5583 (\log I) + 0.4307 F - 0.0820 t \quad R^2 = 0.851 \\ (1.453) \quad (0.116) \quad (0.052)$$

III. Grower (on-tree) level; seasonal, 1929 through 1941 and 1947 through 1959.

$$(6s) \quad \hat{p}_f^g = -38.865 - 0.0802 \frac{q_f}{(0.032)} - 0.1126 \frac{q_j}{(0.036)} + 7.9464 \frac{(\log I)}{(1.248)} + 0.3669 \frac{F}{(0.0972)} - 0.1015 \frac{t}{(0.0447)} \quad R^2 = 0.701$$

$$(7s) \quad \hat{p}_f^g = -38.180 - 0.0785 \frac{q_f}{(0.033)} - 0.1137 \frac{q_{jd}}{(0.037)} - 0.0929 \frac{q_{jo}}{(0.075)} + 7.8956 \frac{(\log I)}{(1.289)} + 0.3586 \frac{F}{(0.103)} - 0.1027 \frac{t}{(0.046)} \quad R^2 = 0.703$$

TABLE VI-7  
Quantity Residuals, Retail Level Equations  
Winter Lemons

Years	October	November	December	January	February	March	April
$q_f^r - \hat{q}_f^r$ (equation 1w)							
1952-53	-24.9	-14.0	-15.2	5.4	3.6	-0.3	-35.3
1953-54	22.9	-11.7	6.1	-2.2	0.3	24.6	21.8
1954-55	-0.2	11.1	15.9	7.5	12.6	1.2	10.8
1955-56	-18.9	-6.8	-7.0	-5.6	5.3	9.6	-8.5
1956-57	-1.6	12.6	-5.5	-14.1	-20.3	-11.7	-1.9
1957-58	16.2	17.8	22.8	43.0	9.5	2.9	9.5
1958-59	6.4	-8.9	-17.1	-33.9	-10.9	-26.3	3.7
$q_1^r - \hat{q}_1^r$ (equation 2w)							
1952-53	-48.4	17.8	12.8	13.2	22.7	-0.2	-86.2
1953-54	25.9	58.4	19.6	35.5	40.3	5.4	-33.7
1954-55	-34.6	14.8	6.1	0.8	8.1	19.1	14.9
1955-56	-82.3	-13.0	-7.2	3.2	9.5	-21.4	-61.7
1956-57	15.5	-49.3	-8.0	10.2	-12.0	50.9	4.3
1957-58	44.6	-5.7	7.9	-15.6	-12.6	-33.5	45.9
1958-59	79.3	-23.1	-31.1	-47.4	-56.1	-20.3	116.5
$q_j^r - \hat{q}_j^r$ (equation 3w)							
1952-53	2.5	6.2	-0.5	4.3	-1.4	-1.6	-7.6
1953-54	-0.2	-1.6	-2.6	1.6	-5.7	-0.3	3.7
1954-55	5.6	5.9	1.7	8.1	7.5	-0.2	1.4
1955-56	-11.9	-5.6	-7.9	-5.3	-1.8	-5.3	-2.4
1956-57	1.2	-1.2	4.7	2.2	-3.1	2.6	-0.7
1957-58	-1.3	1.0	2.2	-10.5	3.0	4.2	4.4
1958-59	4.1	-4.7	2.4	-0.5	1.5	0.5	1.1

TABLE VI-8  
 Quantity Residuals, Retail Level Equations  
 Summer Lemons

Years	May	June	July	August	September
$q_f^r - \hat{q}_f^r$ (equation 1s)					
1953	-92	-19	-20	-19	-4
1954	4	111	56	2	-31
1955	-23	16	52	35	-24
1956	23	13	-23	-52	18
1957	12	-90	4	13	21
1958	58	22	-2	44	14
1959	19	-53	-67	-23	7
$q_1^r - \hat{q}_1^r$ (equation 2s)					
1953	0.02	-0.33	-0.11	-0.20	0.53
1954	0.36	0.13	-0.20	-0.30	0.04
1955	0.01	0.02	0.05	0.22	0.04
1956	-0.13	0.06	-0.14	-0.33	0.04
1957	-0.08	0.03	0.33	0.12	-0.29
1958	-0.07	-0.01	0.14	0.31	-0.19
1959	-0.12	0.08	-0.08	0.18	-0.18
$q_j^r - \hat{q}_j^r$ (equation 3s)					
1953	-14.7	-0.4	10.4	3.0	-8.5
1954	3.2	1.0	-11.2	9.5	-2.9
1955	2.1	4.0	9.8	-2.1	-5.7
1956	6.1	8.1	-1.9	-5.6	4.9
1957	-5.4	8.8	-7.1	2.5	-2.8
1958	2.2	-2.4	0.4	-2.0	5.6
1959	6.4	-19.1	-0.4	-5.3	9.5

TABLE VI-9  
Price Residuals, Winter Lemons  
Seasonal Equations

Season	Equation			
	4w	5w	6w	7w
	dollars per box			
1929-30	0.40	0.38	0.19	0.18
1930-31	-0.99	-0.99	-1.04	-1.05
1931-32	-0.66	-0.64	-0.46	-0.45
1932-33	0.22	0.25	0.35	0.38
1933-34	0.44	0.45	0.52	0.53
1934-35	-0.16	-0.18	-0.07	-0.09
1935-36	0.63	0.62	0.54	0.54
1936-37	0.63	0.61	0.61	0.60
1937-38	0.25	0.25	0.18	0.18
1938-39	-0.59	-0.60	-0.67	-0.68
1939-40	0.09	0.07	-0.04	-0.06
1940-41	-0.71	-0.75	-0.96	-0.99
1946-47	0.10	0.17	0.24	0.30
1947-48	-0.66	-0.58	-0.51	-0.44
1948-49	0.74	0.83	0.95	1.03
1949-50	0.58	0.54	0.60	0.56
1950-51	-0.59	-0.53	-0.56	-0.51
1951-52	0.58	0.61	0.79	0.81
1952-53	0.20	0.33	0.23	0.33
1953-54	0.76	0.58	0.70	0.54
1954-55	0.21	0.10	0.20	0.11
1955-56	-0.11	-0.33	-0.15	-0.34
1956-57	-0.03	-0.43	-0.10	-0.45
1957-58	-0.78	-0.56	-0.85	-0.67
1958-59	-0.54	-0.20	-0.69	-0.39
Durbin-Watson d	1.94	1.97	1.94	1.98
5% d <sub>u</sub>	1.77	1.77	1.77	1.77

TABLE VI-10

Price Residuals, Summer Lemons  
Seasonal Equations

Season	Equation			
	4s	5s	6s	7s
	dollars per box			
1929	-0.15	-0.15	-0.04	-0.05
1930	-0.48	-0.48	-0.40	-0.39
1931	-0.04	-0.04	-0.16	-0.16
1932	0.49	0.50	0.32	0.33
1933	0.11	0.11	-0.02	-0.02
1934	-0.12	-0.12	-0.13	-0.12
1935	0.62	0.62	0.50	0.48
1936	0.22	0.22	0.36	0.37
1937	0.46	0.46	0.61	0.61
1938	-0.51	-0.52	-0.52	-0.53
1939	-0.61	-0.61	-0.53	-0.53
1940	-0.10	-0.10	0.00	-0.01
1941	-0.85	-0.85	-0.61	-0.61
1947	0.88	0.88	0.67	0.68
1948	0.16	0.16	0.03	0.05
1949	0.57	0.57	0.54	0.58
1950	-0.67	-0.67	-0.63	-0.65
1951	-0.43	-0.43	-0.48	-0.48
1952	0.75	0.76	0.57	0.60
1953	0.68	0.67	0.61	0.58
1954	0.22	0.22	0.28	0.22
1955	-0.53	-0.53	-0.47	-0.51
1956	0.28	0.28	0.34	0.28
1957	-0.70	-0.70	-0.70	-0.64
1958	-0.06	-0.05	-0.06	0.02
1959	-0.20	-0.21	-0.10	-0.11
Durbin-Watson d	1.99	1.99	2.00	2.00
5% $d_u$	1.89	1.89	1.89	1.89

## VII. IMPACTS OF LEMON JUICE IMPORTS ON THE DOMESTIC FRESH LEMON MARKET

In the preceding section were presented economic-statistical analyses of demand relationships among fresh lemons and lemon juice products. Among the variables considered were retail, f.o.b., and on-tree prices, respectively, of domestically produced and marketed fresh shipping lemons; the domestic shipments of fresh lemons; consumer purchases of lemon juice products; imports of lemon juice products; and consumers' personal disposable income. Winter (November-April) and summer (May-October) marketing shipments, referred to as winter lemons and summer lemons, were analyzed separately in view of their differing market-demand characteristics.

The findings of the economic-statistical investigations have been set forth in the preceding section. In this section, particular attention is given to the meaning of the findings with reference to the economic impacts of lemon juice imports on the domestic fresh lemon market and especially the price of domestically produced and marketed fresh lemons. Involved is the examination of market interrelationships among components of the domestic lemon industries.

### Winter Lemons

Through economic-statistical analyses and investigation of the demand for winter fresh shipping lemons, it is clear that their f.o.b. market price, on an average seasonal basis, is affected by certain major influences. As the shipment of domestic fresh winter lemons increases, that influence by itself is associated with a decrease in the seasonal average f.o.b. price of fresh lemons. Also, as the consumer purchases of lemon juice products increase, that influence by itself is associated with a decrease in the seasonal average f.o.b. price of fresh lemons. Further, as the level of United States personal disposable income increases, that factor by itself brings about an increase in the seasonal average f.o.b. price of fresh winter lemons.

The above relations for the f.o.b. market demand for fresh winter lemons may be restated in the following terms: The f.o.b. price is adversely affected by increases in fresh lemon shipments and also adversely affected by increases in consumer purchases of lemon juice products; the f.o.b. market price is positively affected by increases in the level of disposable income. The magnitude

of the effects, adverse and positive, have been noted in the previous section. Here it only may be noted that their occurrence is real and measurable and not a matter of mere conjecture or imagined concern.

Since the f.o.b. market price for fresh winter lemons is distant from the returns faced by lemon growers, there is the relevant question as to what are the relations of on-tree returns to lemon growers for their fresh shipping winter lemons. Again, the economic-statistical investigations may be drawn upon and the results summarized as follows: The seasonal average on-tree price received by growers for fresh winter lemons is adversely affected by increased winter shipments of fresh lemons and also adversely affected by increased consumer purchases of lemon juice products; further, increases in the level of disposable personal income bring about an increase in the on-tree price of winter lemons shipped fresh.

These relationships for the on-tree price of fresh winter lemons are consistent with those noted above for the f.o.b. market price of winter lemons. The economic-statistical evidence, thus, is reasonably clear that the price impacts at the f.o.b. market level for fresh winter lemons are sufficiently strong so that they are reflected back through the supply-pipeline distribution system and have a measurable and significant effect on the on-tree returns received by lemon growers.

In view of the particular interest and orientation of this report toward the impacts of lemon juice products on the prices and returns of fresh winter lemons, and especially the impacts of lemon juice products imports, it is relevant to break apart the lemon juice influence into two segments--those from domestically produced lemon juice products and those from imported juice products. To that end, the economic-statistical investigations also analyzed the respective influences of the domestic and imported lemon juice products on fresh winter lemon prices, both at the f.o.b. and on-tree levels of the lemon marketing system.

The findings of this approach corroborated those of the previous one in that increased shipments of fresh winter lemons have an adverse effect on the f.o.b. fresh lemon price at both the f.o.b. and grower on-tree levels of the marketing system; also that an increase in the level of consumer income has a positive effect on the f.o.b. prices of fresh winter lemons at both the f.o.b. and on-tree levels. But of particular notice is that the influences of both

domestic and imported lemon juice products, respectively, have similar and corresponding impacts on the seasonal average prices of fresh winter lemons. An increase in the volume of consumer purchases of lemon juice products manufactured from imported lemon products stock, has an adverse effect on the price of fresh winter lemons, as does an increase in the volume of consumer purchases of lemon juice products originating from domestically produced lemons; and this price effect occurs at both the f.o.b. market level and the grower on-tree supply point of the domestic lemon industry. Before considering the market supply-demand mechanism through which these price effects of imported lemon products have impact on the fresh lemon prices, it is necessary to review the situation in summer lemons.

#### Summer Lemons

The market for summer fresh lemons is particularly appropriate for the analysis of the impacts on fresh lemon prices from lemon juice products, particularly those manufactured from imported lemon products stock. This is so because of the seasonal market situation in lemon juice products, of which lemonade concentrate is a major item and which attains seasonal peaks in consumer purchases during the summer period.

As was done for winter lemons, the economic-statistical investigations discussed in the previous section of the report analyzed the relations of major market influences on the prices of fresh summer lemons at both the f.o.b. and grower on-tree levels. The influences included domestic shipments of fresh summer lemons, consumer purchases of lemon juice products (in total and from domestic and imported sources, separately), and disposable personal income.

The nature of the findings can be interpreted in the following terms: The seasonal average price of fresh summer lemons is adversely affected by an increase in the f.o.b. shipments of fresh summer lemons and also is adversely affected by increased consumer purchases of lemon juice products. Increases in the level of disposable personal income are associated with an upshift in demand for fresh summer lemons, and there has been a tendency toward a downshift in the demand for fresh summer lemons over the period investigated (1929 to 1941 and 1947 to 1959). These demand relations and price effects are evident and measurable at both the f.o.b. and grower on-tree levels of the lemon marketing system.

Also, as in the situation in winter lemons noted earlier, for summer lemons the seasonal average price of fresh shipments is adversely affected by an increase in the volume of consumer purchases of lemon juice products manufactured from imported lemon juice stock, as well as being adversely affected by an increase in the volume of consumer purchases of lemon juice products manufactured from domestically produced lemons. Again, these price effects are evident at both the f.o.b. and grower on-tree levels.

It thus becomes clear, once again, that the imports of lemon juice products have a direct bearing on the market demand for fresh lemons. The effect is clearly evident through the impact on the prices of fresh lemons: An increase in the consumer purchases of lemon juice products (whether in total or manufactured from imported lemon juice stock or from domestic lemons) tends to depress significantly both the f.o.b. price and grower on-tree returns of fresh lemons. In specific terms, the imports of lemon juice products adversely affect the domestic fresh lemon market as do increased volumes of lemon juice products made from domestically produced lemons.

#### The Supply-Demand Mechanism

In view of the economic-statistical findings in the previous section, and as summarized immediately above, it is pertinent to trace out the supply-demand mechanism whereby the impacts of imported lemon juice products on the fresh lemon market come about. Such procedure also provides additional background for the consideration of implications for domestic marketing policy and programs discussed in the following section of the report.

First may be noted that imports of lemon juice products are not directly purchased by terminal consumers. The imports are procured by manufacturers of juice products, as lemon juice and concentrated lemonade, for processing and packaging into institutional and consumer size cans or glass containers. The imports may be either the lone base of the manufactured item sold on the domestic market, or they may be blended with domestically produced lemon juice stock to yield the end item. In either case they replace lemon juice or lemon juice products made from domestic lemons. The replacement can be made without complications and result in quality end items, for, except in unusual cases where adulteration or deterioration has occurred, the imported stock can be of equivalent quality and specifications as the domestic stock. Thus, the flow

of imported lemon juice enters into the supply of lemon products used by manufacturers of consumer items.

With the replacement of imported lemon juice stock for that produced from domestic lemons, the outlet for the latter is reduced. This results in either the building up of inventory of domestically produced lemon juice products or the lowering of their price in order to encourage their sale. In either event there is a depressing effect on the domestic lemon products price and the returns to domestic growers of products lemons.

In addition to influences sketched above with respect to the supply side of the domestic lemon products market, there are influences also operating on the demand side. Because of equivalent product characteristics, terminal consumers are unaware or indifferent as to whether the lemon juice products they purchase are made from domestically produced lemons or imported lemon juice stock. It is not because of preference that consumers purchase lemon juice products manufactured from the imports; rather, it is because of indifference or unawareness. In either event, the result is the same--the replacement of imports for domestically produced lemon juice.

These supply-demand interrelations occur in the lemon juice market. But the demand for lemon juice products does not come about in an isolated market. Earlier studies had established,<sup>1/</sup> and the economic-statistical investigations presented in the previous section further support, that the fresh lemon and lemon juice markets are interrelated. Interconnections come about through the demand interrelations among fresh lemons and processed lemon juice at the consumer level. Consumers tend to shift back and forth between fresh lemons and processed lemon juice in response to price relations among them. The two submarkets are interlocked, and what occurs in one affects and is affected by what occurs in the other. In terms of supply-demand market operations, in fact, the fresh lemon market and the lemon juice market comprise in an economic sense components of a single overall market for lemons and lemon juice products. It is through the existence and operations of such an overall market, with its interrelated components, that supply-demand developments in lemon juice products bear upon and affect supply-demand developments in fresh lemons.

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1/ Hoos and Seltner, Lemons and Lemon Products . . ., op. cit.

Hoos, Lemons--Fresh and Products . . ., op. cit.

It is relevant to note that the supply-demand influences of imported lemon juice make their impacts on the fresh lemon market through the general market for lemon juice products which are directly interrelated with the fresh market. Thus it is by means of roundabout influence, albeit an effective one, that lemon juice products imports affect the market price of fresh lemons. But as the economic-statistical investigations in the preceding section have shown, the effects of lemon juice products imports on the fresh lemon market prices can be analyzed and measured to demonstrate that increased imports of lemon juice products tend to depress the fresh lemon market prices.

## VIII. IMPLICATIONS FOR DOMESTIC MARKETING POLICY AND PROGRAMS

With the establishment of the economic-marketing fact that importations of lemon juice products adversely affect the market prices (f.o.b. and on-tree) of California-Arizona fresh lemons, there is the question as to what are the implications for the California-Arizona lemon industries in terms of marketing policies and programs. Consideration of the question involves the operations of the fresh and products components of the lemon market.

### The Federal Marketing Agreement-Order Program

Since 1941 California-Arizona lemons for fresh use have been marketed under a federal marketing agreement-order program based on the federal Agricultural Marketing Agreement Act of 1937 and amendments thereto. Through the program, the industry, under the authority of and with the approval of the federal Secretary of Agriculture, regulates the volume of fresh lemons shipped over specified periods of time. The industry's Lemon Administrative Committee, with recommendations to the Secretary of Agriculture, operates the "lemon prorate" program. Its objective is to influence the prices of fresh lemons by regulating the flow of fresh lemon shipments.

The legislation underlying the federal marketing agreement-order for lemons does not provide for or permit the direct regulation of products lemons or lemon products. The order's direct influence is on the flow of fresh market shipments and thereby indirectly on fresh market prices and returns. Movement into lemon products channels is considered only indirectly and in a residual sense; the lemon crop for which fresh shipments are not provided through the federal marketing order is left to be allocated or channeled into lemon products outlets. It is through the operation of the fresh lemon marketing order that relative stability over years has been attained in the volume of fresh lemon shipments, and the increasing crop production had to be absorbed by the processing of lemon products.

In the early years of the fresh lemon marketing order, when the types of lemon products then manufactured were in the main not competitive in consumption with fresh lemons, the order's operation was able to affect favorably the prices of fresh lemons without introducing complicating side effects. But as the consumer demand for and use of processed lemon juice and frozen lemonade concentrate expanded, beginning in the early 1950's, the market situation changed. The increasing volumes of these new lemon juice products for consumer use were directly

competitive with fresh lemons, and interactions were generated because of the consumer demand interrelationships between fresh lemons and the manufactured lemon juice products. Thus, as increasing volume of lemon juice products became available for sale, a dampening effect resulted on the fresh lemon prices. Consumers, on a per-capita basis, maintained, and even increased, their total consumption of fresh lemons and lemon juice products, although the former tended to become a decreasing proportion of the total.

These and related developments attracted attention to the need for some type of regulation of the products market. Since a mechanism was not available under federal marketing legislation, the industry turned to legislative authority under the California Marketing Act. A California marketing order was operated from 1950-51 to 1955-56 to control the utilization of products lemons. By such means, in combination with the demand situation for products lemons, grower returns for processing lemons increased substantially. But the higher prices for products lemons and lemon juice products stock encouraged the importation of juice products supplies from abroad, and such imports could be economically made over the tariff duty structure. The existence of such leakage, along with the encouragement of plantings in new as well as established areas due to the prices of products lemons, led to the abandonment of the lemon products marketing order under California state legislation.

#### Regulating Fresh Lemon Shipments

Hence, the domestic lemon industry was left with the federal marketing agreement-order for fresh shipping lemons as the only institution for regulating marketing. In years of normal or average-sized crops, the working of the order was feasible in that shipments could be controlled to fresh market to affect their prices and returns, and the portion of the crop not shipped fresh went into lemon juice products whose prices did not encourage imports, although lemon juice products continued to compete with fresh lemons.

The situation, however, was not so tolerable in the years of short crop. Fresh shipments could be made so as to meet market demands at returns reasonably favorable to distributors and growers. But the price situation in products lemons and lemon juice products encouraged the importations of lemon juice products stock over the tariff structure. This resulted in further supplies of lemon juice items to compete with fresh lemons and counteract the objective of the federal marketing order for fresh shipping lemons.

In years of abnormally large crops, the federal order again permitted control of shipments to the fresh market and thereby affected its prices and returns. But the rigidly restricted nature of the fresh market limited the volume it could absorb without resulting in unfavorable prices and returns to growers. And in such years with abnormally large crops, the volume of lemons available for processing was so large that very low (and even negative) returns were received by growers for processing lemons. Although such low prices for products lemons and lemon products stock inhibited importation of lemon juice, the returns picture facing growers was extremely unfavorable. Even with normal or average-sized crops, grower returns from processing lemons were at a break-even point, or only nominal returns were received by growers. But with extra-large crops, substantial negative returns were faced by growers for their processing lemons, as for example in 1958-59 and in 1959-60.

With the supply of processing lemons available from domestic lemon production, even with average-sized crops, care need be taken in the management of the fresh lemon marketing order so that the fresh market is not eroded through encouraging accelerated consumption shifts to lemon juice products, since the foundation of grower returns from their orchard production stems from the fresh market. Even greater care is called for in years of large crops, when the lemon juice market structure can seriously depress the fresh market prices and the overall returns from the crop. Short crop years, however, also require careful management of the fresh lemon marketing order; not only can juice imports by processors be encouraged, but the fresh market demand can be affected.

It is reasonably clear that, in the administration and operation of the federal fresh lemon marketing order, both the industry through its Lemon Administrative Committee and the Secretary of Agriculture under whose authority the order operates, have the problem of steering through Scylla and Charybdis. For effective management, there is only a rather narrow range of economic tolerance.

The economic influences which lemon marketing policy and programs must recognize, and within which they must operate, may be outlined in the following terms: From the view of grower returns for their lemon crop, it is the fresh market sales which must be looked to by sales agencies for satisfactory prices; returns from products, under present market conditions, are either very low, break even, or are negative. Too wide disparity between consumer prices for fresh lemons and lemon juice products erodes the fresh market and induces consumers' shifting to further use of lemon juice products. If the prices for products lemons and

domestic lemon juice stock for manufacturing lemon juice products exceed the import price plus the tariff duty, some processors are induced to procure imports to meet their processing needs. Lemon juice products imports which do occur adversely affect the grower returns not only from products lemons but also the f.o.b. and grower on-tree prices for fresh market lemons. Without regulation of fresh shipments, as through the federal marketing order, grower returns from fresh shipping lemons and the entire crop can be expected to be drastically low in view of the demand nature of the market and the volume of current and prospective crop production.

#### Marketing the Lemon Crop in View of Lemon Juice Import Potential

Fresh market sales have for long yielded substantially more favorable f.o.b. and grower on-tree prices than processing lemons or lemon juice products. In view of the supply-demand nature of the fresh and processed markets, this type of relation between fresh and processed lemons can be expected to continue. The existence of consumption competition between fresh lemons and lemon juice products, with consumers shifting from one form of lemons to the other in response to relative price differences, can also be expected to prevail. Those domestic processors who are not grower oriented, as are cooperatives, or who do not have commitments with domestic lemon growers, can be expected to import lemon juice products stock over the prevailing tariff duty when it is pricewise favorable for them to do so and no limitations on their imports exist. That the imports of lemon juice products adversely affect the price of domestic products lemons and lemon products, and also the f.o.b. and grower on-tree prices of fresh shipping lemons, is another economic fact that cannot be changed in the present context of the lemon trade. Also must be recognized that, in view of the current and prospective volume of domestic lemon crop production, the federal marketing order for fresh shipping lemons is a type of institutional arrangement by which drastically low f.o.b. and grower returns for the lemon crop as well as fresh shipments can be avoided.

To some observers it may appear that marketing constraints and economic-marketing facts do not permit a breaking out of the shackles within which the domestic lemon industry presently finds itself. Such a view, however, is not completely valid. Some significant improvement, if not a complete solution, can be attained.

Continuation of vigorous and persistent merchandising and promotion can and must be carried forward to lift the demands for, and increase the sales of, fresh lemons and lemon juice products. Market expansion through the shifting upwards of demand can be fostered. However, past and recent experience suggests that such endeavors cannot be expected to yield complete or immediate solutions; rather, they are partial approaches whose cumulative effects require a considerable period of time.

The federal marketing order for fresh shipping lemons may be operated and managed so as to temper the erosion of the fresh market from inroads by the lemon juice products market. This may call for some sacrifice of returns from the fresh market in the short run, but may well be beneficial to the domestic lemon industry from the longer run view. A more direct approach, with more immediate effects, would be an adequate raising of the tariff duty structure for lemon products, the imposition of import quotas, or some combination of the two. Such an approach, of course, would require action by appropriate federal agencies. In view of the economic-marketing fact that imports of lemon juice products affect the f.o.b. and grower on-tree prices of fresh lemons, and thereby the operation of the federal marketing order for fresh lemons, Section 22 of the Agricultural Adjustment Act (as amended) is relevant. This is a matter for industry consideration.

It is pertinent also to note, however, that involved are national policy and attitudes with respect to international relations, principles of international trade in a context broader than the lemon industry, and the overall economic environment within which the lemon industry operates. Matters and considerations such as these require attention on the part of the domestic lemon industry in its choice of a course of action. Yet, in terms of the economic-marketing aspects, from the view of the domestic lemon industry, the impacts of lemon juice products imports on the domestic fresh lemon market as well as the products market are reasonably clear.